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A Record of the Progress of Pharmacy and the Allied Sciences

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THE AMERICAN
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VOL. 104 JUNE, 1932 No. 6

EDITORIAL

THE SMALL TOWN DRUGGIST

THE DRUGGIST in the small town sometimes envies his competitor in a larger community. The small town druggist, however, may well realize that he has a mission to perform and an opportunity. He is an educator and, as such, may rightly rank with the clergyman, the teacher, and the physician.

In the majority of cases he is a very influential man in his community. If he is alive to his responsibility, he will take advantage of his position by advising his patrons on the purchase and use of articles of real merit; articles which he knows to be the best; articles which his customers will quickly find are the articles which they desire. The small town druggist will do well not to yield to the price-cutting feature, and in this respect attempt to emulate his city competitor. If he keeps his standard high and handles only articles of real worth he will find his future bright. The old-time adage "Once a customer, always a customer," applies with great force to the small town druggist.

In a store of this kind, the prescription department can be made profitable, even though the prescriptions average but few. Each day the profits of this department, by the means which it provides for additional sale of household and sickroom supplies and other sundries, will substantially increase the earnings of the store.

To insure a continued prescription business in his locality, the druggist can arrange with the physician to handle his 'phone calls when the physician is absent from his office. This simple procedure offers a splendid medium for getting the druggist in close touch with the people. When the people come to realize that the health and welfare of the individual and the community centre about the druggist's place

of business, it will not only enhance prestige, but will swell the volume of receipts and thus spell success.

Educating the people to call the drug store when in need of a veterinarian, a physician, a nurse, or other aid in time of sickness and trouble will accrue to the benefit of the store.

The innumerable articles purchased by women present a live opportunity to push the sale of high-class stationery, art sundries, and like commodities.

It has also been found a good policy to carry a stock of tablet school paper and other school supplies.

Above all, the small town druggist should not forget the farmers' trade. They are large users of drug store commodities. The farmers as a class live well; have all modern conveniences; and do their shopping in an automobile. The druggist must make himself an integral part of the farmer's life and welfare, so that he will purchase goods from the home drug store, and not from the big town or county seat stores.

The personal element plays an important role in modern merchandising, and no one is better fitted for this than the druggist in the small town. A recent writer gives the following: "Stand on your own feet, Mr. Small Dealer. Throw out your chest. Without you, the wheels of business would cease to turn. Close your eyes and ears to the hullabaloo your cut-price competitor is making. Incorporate method into your business. Show your customers real service."

FRED B. KILMER.

SELECTED EDITORIAL

THE TREATMENT OF STRYCHNINE POISONING*

STRYCHNINE poisoning is rather frequent, and its occurrence is rendered dramatic by the dreadful agony of its course and the commonly fatal termination. Most of the sources of poisoning could be easily avoided especially in the tragic cases of infants. Moreover, the agony of the developed poisoning can be completely eliminated and nearly all fatalities could probably be prevented by proper treatment.

Strychnine poisoning is sometimes suicidal or homicidal; occasionally it occurs from eating poisoned vermin bait;[1] but the most prolific source of strychnine poisoning is chocolate or sugar-coated household laxative or "tonic" pills, which are left carelessly around the home and which look so much like candy that young children swallow them by the handful. The sweet and alcoholic "tonic" elixirs may also be a source of danger. The frequency of accidental strychnine poisoning has been reviewed by Aikman.[2] In the death registration area of the United States, in the three years 1926-1928, strychnine was reported as a cause of 546 deaths, or more than three a week. In the same period, the statistical bureau of the Metropolitan Life Insurance Company[3] reports that strychnine was responsible for about a third of the accidental poison deaths in children under five years of age insured in the company. This dreadful slaughter is the more regrettable since it has not been proved that the strychnine in these pills serves any useful purpose whatever in most patients. Generally the strychnine is merely a concession to the polypharmacal shotgun era. It has been retained on the easy-going assumption that, if it did no good, it could do no harm—to those who take the pills according to directions. Unfortunately, this is a good deal to expect of a child who cannot read and who takes the pills because they look like candy. Some restriction of the promiscuous sale of this violent poison in the guise of supposedly harmless household remedies is necessary. The trustees of the American Medical Association are considering the advisability of urging action along this line on pharmaceutic manufacturers.

The treatment of strychnine poisoning includes chemical antidotes, evacuation of the stomach, and sedatives. Since the strychnine spasms

*Reprinted from *Jour. A. M. A.*, 98:1992 (June 4, 1932).

are provoked by anything that would startle a normal person, all sudden stimuli, however slight, must be strictly avoided. Gradual, steady movements for which the patient is prepared are harmless, and gently soothing handling and reassurance of the patient are fairly effective in mitigating even the established spasms, if these are not too violent.

Chemical antidotes are useful only against the unabsorbed poison, and chiefly against that which has not yet passed the pylorus. Either potassium permanganate solution or animal charcoal is quite effective in animal experiments. The charcoal does not destroy the poison but slows its absorption so much that it can be effectively destroyed in the tissues. Diluted iodine tincture or solution, and tannin, are useful chiefly as temporary measures preceding evacuation. Gastric lavage may be used early, before the patient has become hypersensitive, or later, when the sedatives have taken effect. If the patient is hypersensitive, evacuation should be secured by apomorphine, hypodermically (1/5 grain, or 0.013 Gm., for adults, 1/10 grain, or 0.006 Gm., for infants), since this tends actually to quiet and prevent convulsions.[4]

If the patient already has spasms or is even hypersensitive, sedatives should be administered freely. They ease the anxiety of the patient and suppress the painful spasms, and if they are used with intelligence and courage they diminish the fatality to a greater degree than is commonly realized, chiefly by preventing asphyxia from tetanization of the respiratory muscles. All sedatives are good, but some are much better than others. Quick action is imperative, and gastric administration is therefore undesirable, especially if the stomach has been upset by antidotes or lavage. Inhalation of chloroform is quite effective and may be used temporarily for immediate relief, although it is somewhat dangerous in view of the strain on the heart and the difficulty of controlling the vapor concentration during spasms. It should not be prolonged for fear of postanesthetic toxicosis. Ether inhalation is safer but less effective, and it is also inadvisable to prolong its administration. Nitrous oxide should not be used, since it exaggerates the reflex excitability and the asphyxia. Chloral hydrate, by rectum if necessary, was formerly esteemed as one of the most effective sedative antidotes, but the large doses required came to be considered unsafe. Other earlier aliphatic hypnotics also were unsatisfactory, since their action after oral administration was too slow and the effective dose, in many instances, too dangerous.

The barbituric acid derivatives have now opened a new chapter in the treatment of strychnine poisoning. They do not differ from the older hypnotics in principle but rather in the combination of high efficiency with relatively high safety, and especially by the fact that they may be administered intravenously in emergencies and therefore secure an effect that is immediate and the duration of which may be timed by the dose, by the repetition of the injections, and by the selection of the barbiturate. In such emergencies, intravenous injections are justified, not only by the need of immediate relief but also because the immediate effect permits the adjustment of the dosage to the desired response.

The anticonvulsant efficiency of the barbiturates first came into prominence in connection with cocaine poisoning.[5] In 1929, Soma Weiss[6] reviewed the successful use of subcutaneous, intramuscular and intravenous injections of sodium phenobarbital against the convulsions of eclampsia, epilepsy, procaine and traumatic tetanus. Zerfas and McCallum,[7] summarizing their experience with intravenous injections of sodium amytal, state that "it is practically specific for the treatment of strychnine poisoning. . . Experimental animal work has shown that rabbits may be protected against several times the fatal dose of strychnine sulphate." No data are given. These authors also mention three clinical cases, all successful:

> A patient entered the hospital, in a series of continuous convulsions, after having swallowed two hundred one-thirtieth grain tablets of strychnine sulphate. He was cyanotic and was having great difficulty in breathing; 0.8 Gm. (12 grains) of sodium isoamylethyl barbiturate, given intravenously, checked the convulsions almost instantly, and the following day he was released from the hospital. Two other patients in a similar condition owe their lives to this treatment.

The amount of strychnine sulphate in the first of these cases was equivalent to 400 mg., or about four times the ordinary fatal dose, by mouth. However, recovery from doses of this magnitude have been reported by the older methods of treatment.[8] Dawson and Taft[9] found that this antagonism is shared by other barbiturates. With subcutaneous injection, strychnine sulphate is generally fatal to rabbits in the dosage of 0.6 mg. per kilogram. Administering double this fatal dosage, they then injected various barbiturates by vein "immediately with the onset of convulsions, and repeated as judged necessary to control their recurrence." All the treated animals sur-

vived, the necessary dosage of the barbiturate being, for pentobarbital, 14 mg.; for amytal, 15 mg.; for phenobarbital, 30 mg.; for pernocton, 40 mg.; for sodium barbital, 150 mg.; and for chloral, 220 mg.

Swanson [10] has found that the intravenous injection of sodium amytal, 50 mg. per kilogram in a single dose, given simultaneously with the strychnine, saved rabbits from seven times the fatal dose (4 mg.) of strychnine sulphate, hypodermically.

A little more recently, Haggard and Greenberg [11] compared the antidotal potency of magnesium sulphate, apomorphine and sodium phenobarbital, administered intraperitoneally, chiefly on rats. Magnesium, with the doses used, did not diminish the fatality; apomorphine antagonized only slightly more than twice the fatal dose, but phenobarbital saved from five times the fatal dose of strychnine. The required dosage of the barbital would have been fatal to normal animals, so that the strychnine is also somewhat antagonistic to barbital poisoning. The phenobarbital also saved dogs from four times the fatal dose of strychnine.

In the meantime, Barlow,[12] as reported in this issue of *The Journal,* had started to extend the observations of Dawson and Taft to higher dosages of strychnine, as a demonstration experiment on antagonism. By rendering the dosage flexible, injecting pentobarbital intravenously, in rather moderate dose, 10 to 12 mg. (about one-fifth of the minimum fatal dose) with the first convulsion and repeating this injection whenever strong convulsions recurred, rabbits could be saved from as much as thirty-five times the fatal hypodermic dose of strychnine; above twenty fatal doses of strychnine, however, the required quantity of pentobarbital, which increases with the dose of strychnine and reaches seven to ten doses of the barbital at that point, becomes so high that half or so of the animals, above this dosage, are killed by the barbital, the antagonism of strychnine against barbital being much less effective than that of barbital against strychnine.

The fractional intravenous injection of pentobarbital has not been tried in clinical poisoning. Barlow suggests the dosage of one-tenth grain (0.006 Gm.) of sodium pentobarbital per pound of body weight, for the first injection, and one-half of this dosage (one-twentieth grain per pound) whenever convulsions recur. Caution should be used if more than four injections are given during the first two or three hours. This dosage is within safe limits and could probably be increased with little risk, if necessary.

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ORIGINAL ARTICLES

"TRIUMPHS OF MEDICINE"*

By Wilmer Krusen, M. D., D. Sc., LL. D.

President, Philadelphia College of Pharmacy and Science

Happiness and Science dawn though late upon the earth;
Peace cheers the mind, health renovates the frame;
Disease and pleasure cease to mingle here,
Reason and passion cease to combat there;
Whilst mind unfettered o'er the earth extends
Its all subduing energies, and wields
The sceptre of a vast dominion there.

—*Shelley, The Daemon of the World.*

THUS WROTE "Mad Shelley," who always combated the despotism of custom a century ago,—so often we find that the poetic dreamer while not practical is prophetic.

To compress the story of the triumphs of medical science in one lecture is a Herculean task—a superhuman feat that no one can accomplish. I can barely enumerate the achievements by name and cite a few typical diseases conquered as illustrative of the methods of warfare employed and indicative of future possibilities and progress.

The history of medicine fills ponderous tomes and the making of new books on this theme is a perennial phenomenon. During the past few decades the progress has been so rapid that it is difficult to keep apace and abreast with the procession. The dream of yesterday is the probability of today and will be the realization of tomorrow.

The future is rich in promise and we stand on the threshold of still greater achivements and triumphs. The scientist must ever possess the analytical and receptive mind ready to abandon error when new truth reveals itself.

"New occasions teach new duties,
Time makes ancient good uncouth."

The human body is a miracle so great that the cleverest scientists for all their knowledge only faintly comprehend it. For ages men have been striving to unveil the inner mystery of its physiology and solve the problem of those ills which destroy this delicate human or-

*One of a Series of Popular Science Lectures given at the Philadelphia College of Pharmacy and Science, 1932 Season.

ganism, so intricate and complex in its weakness and strength—so marvelous in its adaptability—truly the proper study of mankind is man.

"I am fearfully and wonderfully made," sang David in the one hundredth and thirty-ninth Psalm, and he knew much of human frailty and disease—and according to Jewish Tradition wise King Solomon enjoyed special renown for his skill in healing and Legend even ascribes to him the publication of a work on diseases and their cure, in which his collaborator was the proud King Hezekiah—but we must turn to the Apocrypha to find an account of the high esteem in which he was held in the words of Jesus, the son of Sirach (180 B. C.), who lived after the period of Hippocrates, and wrote in the 38th Chapter of Ecclesiasticus the following tribute:

> "1. Honour a physician with the honour due unto him for the uses which ye may have of him: for the Lord hath created him.
>
> 2. For of the most High cometh healing, and he shall receive honour of the king.
>
> 3. The skill of the physician shall lift up his head: and in the sight of great men he shall be in admiration.
>
> 4. The Lord hath created medicines out of the earth; and he that is wise will not abhor them."

But centuries before David and the son of Sirach—Moses, the lawgiver and director of health of the Israelites, had drawn up a rational sanitary code for the Hebrews, and it became a part of their religious law. Sanitation became a religious observance and the priests were sanitary police.

The Pentateuch is full of hygienic recommendations, indicating knowledge of the contagiousness and prevention of certain diseases—notably the 13th and 14th Chapters of Leviticus, and when we recall that the Mosaic law was promulgated during the period of the Israelitish training in the wilderness from 1491-1451 B. C., we marvel at the scientific sense exhibited, and as Moses died in 1451 B. C., at the age of 120 years with eyes undimmed and natural force unabated (Deut. 34:7), it requires little imagination to assume that he was familiar with formulae embodied in the Ebers' Papyrus, a scroll of deepest interest to students of medical history.

In the search for the origin of any phenomenon of civilization the investigator strives to bridge over historical time, which repre-

sents a certain height upon the ladder of evolution rather than its lowest rung and seeks the earliest manifestations, even though these are seen but dimly and in uncertain outline. The healing art as a specialty began when as LaWall succinctly states—our troglodytic ancestors commenced to subdivide their labors and assign to certain members of the family, tribe or clan, specific duties connected with common welfare.

The history of medicine is the story of mythological, legendary and historic individuals—the romantic story of many lives—and the biographies of great leaders in scientific thought make fascinating reading. Ludwig in his preface to "Genius and Character," says that "The most modern of all portraitists has been dead eighteen hundred years." He refers to Plutarch, who said, "I record not history, but human destiny," so we may find the proportions and significance of "scientific" events in the portraiture of the men who have laid the world under a perpetual debt.

Shall we try to bridge over that period which divides the legendary and traditional from the more accurate historic era? First, we must learn something. Aesculapius, the legendary Greek God of Medicine, was the son of Apollo and the nymph Coronis (a name not as frequently used in the modern cross-word as the other deities—Ares, Bel, Isis or Ra). Two cities contended for the honor of his birthplace, Tricea and Epidaurus, but an oracle decided in favor of Epidaurus. He was educated by the Centaur Cheiron, who taught him the art of healing and hunting (but it is not recorded that he instructed him in veterinary medicine). His skill in curing disease and "restoring the dead to life" aroused the anger of Zeus, who being afraid that he might render all men immortal, slew him with a thunderbolt—even the gods are jealous of the successful healer! Temples were erected to Aesculapius in many parts of Greece, near healing springs or on high mountains. At Epidaurus was the god's most sacred shrine and games were celebrated in his honor every five years, accompanied by solemn processions. He was a favorite subject of ancient artists. He is commonly represented standing, dressed in a long cloak with bare breast; his usual attribute is a club-like staff with a serpent (the symbol of renovation) coiled round it. He is often accompanied by Telesphoris, the boy genius of healing and his daughter Hygeia, the Goddess of Health. The Hieron, sacred precinct of Aesculapius, has been thoroughly excavated by the Greek Archaeolog-

ical Society since the year 1881. It dates from about 460 B. C. and the records found are of much interest, detailing the method of consulting the god and the manner of his cures. The patient slept in the Abaton, saw certain visions and came forth cured the next morning! Later newer methods were introduced—apparently the old faith curing had lost its efficacy and the priests substituted for it elaborate prescriptions for diet, baths and regimen, which must have made Epidaurus and its visitors resemble their counterparts in a modern spa. Although the priests used these practical means of treatment they wisely assumed no responsibility, but held that the will of the gods determined the success or failure of their treatment.

In the fifth century before Christ a drastic reform in this temple cult of healing was brought about by Hippocrates, the greatest of *ancient* physicians. Under his guidance for the first time medicine was separated from religion. He relieved the gods of the responsibility for disease and placed it upon the shoulders of man. The will of the gods no longer served to cover man's ignorance; man's condition became the man's problem and he must find the solution for himself. The history of medicine from Hippocrates to the present time is the record of the extent of man's acceptance of this responsibility.

HIPPOCRATES Hippocrates was a real and not a mythological character and he deserves careful consideration at this time. He gave rational medicine the general form it has today. A brief sketch of his life is of interest. He was born on the Island of Cos about 450 B. C., the son of Asclepiad Heraclides and received his first medical instruction from his father.

We may sing with Byron:

> "The Isles of Greece! The Isles of Greece,
> Where burning Sappho loved and sung,
> Where grew the arts of war and peace,
> Where Delos rose and Phoebus sprung!'

Because of the ability of this great physician medicine is called the Hippocratic art. The period of Hippocrates influence coincides with that of the highest development of the political, scientific and artistic life of Hellas. It is the epoch which brought forth the statesmanship of Pericles, the philosophy of Socrates, the historical writing of Thucydides; the era of Sophocles and Euripides; of

Phidias and Praxiteles.—Never before nor since has such a brief period of time contained such a wealth of intellect and nobility.

What Socrates was to philosophy, Hippocrates was to medicine. Only a brief summary of his achievements can be detailed. He freed medicine from the fetters of oriental dogmatism. He made it a rational science and freed it from the leading strings of the priestly caste. He formulated the famous Hippocratic oath wherein he laid down the duties of Asclepiad toward teacher, pupil and patient, and defined medical ethics and etiquette. He taught that the good of the patient constitutes the only goal of medical thought and action. "For where love of mankind is, there is also love of art," and declared it impossible that progress in medicine should be attained in any other way than by that of experience.

Each separate case of illness was to him a natural phenomenon which was to be studied with all available aids to observation; personal and vicarious experience being brought to bear upon it with due regard to individual peculiarities and to its affinity with nature as a whole. The patient was to be studied and treated—not a preconceived theory to be supported. He was a true clinician. With scanty knowledge of anatomy and physiology he aimed to assist nature in curing his patient and his writings may be accurately described as daybooks of nature, and he will stand as a shining example of philanthropy and professional faithfulness: a seeker after truth with full consciousness of its being unattainable.

GALEN

But we must pass to the next great character in medical history—Galen, born in Asia Minor in 131 A. D., who developed an elaborate theory of disease and its treatment based on the prevalent metaphysical conceptions of the nature of the body. According to this theory the body, like the universe, was composed of four elements, fire, air, water and earth. The elements represented the qualities of the body; fire was hot, air was dry, water was wet and earth was cold. Disease resulted when the balance between the four qualities was disturbed; and disease was to be cured by administering drugs to restore the proper balance.

Galen administered elaborate mixtures of herbs to restore the proper balance of qualities in the body. (Cucumber seed was cooling, hence the common expression "Cool as a cucumber" is derived from the therapeutic theory of Galen.)

Several thousand drugs were necessary for the Galenic system of therapeutics, and a hundred or more might be included in a single prescription—and revision committees even to this day are kept busy selecting the valuable and eliminating the useless from our Pharmacopœias.

Galen was an energetic experimenter, but his method was faulty in that he insisted on having a theory for every phenomenon, whether or not it had any basis in fact.

After Galen came many names worthy of consideration, but one can only mention them in this lecture.

Avicenna, one of the most eminent of Persian philosophers and physicians of the tenth century, who is said to have founded the Graeco-Arabic school of medicine, and is believed by some authorities to have the quatrains attributed to Omar Khayyam (but that's another story).

Avenzoar (1113), an illustrious Spanish physician, who dared to contradict some of the teachings of Galen.

Maimonides, born at Cordova in 1135, a great Jewish character, and at twenty-five the private physician of Saladin, the scourge of the Crusaders. He is best known to this generation through his idealistic medical creed. "The oath and prayer of Maimonides," which is a fine conception of the duties and responsibilities of the physician, ranking with the older oath of Hippocrates.

Another intriguing and interesting individual was Paracelsus, born in Switzerland in 1493, who not only founded a system of therapy, but dabbled extensively in mysticism. He was appointed Professor of Medicine at the University of Basle, and his first official act was to build a bonfire in his lecture room to burn the works of Galen. He was tyrannical, vulgar and iconoclastic, yet he made notable contributions to medical progress. He ridiculed some of Galenic combinations and introduced simple but powerful medicaments. He used mercury in the treatment of syphilis, a disease which Galen had not described or treated, and curiously enough apart from his useful contributions to medicine and because of their mysticism his writings became one of the principal sources drawn upon by mystical sects and particularly the secret society of the Rosicrucians.

Paracelsus was aware of the value of alcohol in extracting the essence of roots and herbs—and his tinctures from fresh herbs and plants superseded the complicated Galenical preparations of his time

by his more simple tinctures, essences, extracts and metallic salts, and so, *Aureolius Theophrastus Bombastus Von Hohenheim* or *Paracelsus* deserves our recognition, and his life history makes a readable story.

PARACELSUS

He was peripatetic—sometimes of necessity, wandered over a great part of Europe to learn all he could. "The book of nature," he affirmed, "is that which the physician must read, and to do so he must walk over the leaves." If living today he would have advocated the League of Nations, for he said, "The more a man knows of other nations, the better will he understand his own." May we term Paracelsus the "Paradox," for it is a problem how to reconcile his ignorance, his superstition, his crude notions, his erroneous observations, his ridiculous influences and theories with his grasp of method, his lofty views of the true scope of medicine, his lucid statements and his incisive and epigrammatic criticism of men and motives. May his bones rest in peace in the porch of St. Sebastian at Salzburg, where a monument was erected to his memory.

Our great debt to Paracelsus was that for centuries mercury was the specific for syphilis, just as quinine was for malaria; iodine for goitre; ipecac for dysentery, etc. As Holmes has said, "Medicine appropriates everything from every source that can be of the slightest use to anybody who is ailing in any way or likely to be ailing from any cause." "It learned from a monk how to use antimony, from a Jesuit how to cure ague, from a friar how to cut for stone, from a soldier how to treat gout, from a sailor how to keep off scurvy, from a postmaster how to sound the Eustachian tube, from a dairy maid how to prevent smallpox, and from an old market woman how to catch the itch insect. It borrowed acupuncture and the moxa from the Japanese heathen and was taught the use of lobelia by the American savage."

Paracelsus died in 1541, and in 1632 Antony Leewenhoek was born amid the blue windmills and low streets and high canals of Delft, in Holland. He was destined, although never a physician, to aid in medical achievements, for he ground finer lenses and made better microscopes than had ever been made before and he examined and observed every object possible under his lens. He may be properly termed, as De Kruif has called him, the first of the microbe hunters, and if he failed to see the germs that caused human disease, if he had too little imagination to predict the role of assassin for his wretched creatures, he did show that subvisible beasts could devour and kill liv-

ing beings much larger than themselves, and made possible the advent of bacteriology. He was an indefatigable worker, he had Dutch thrift, obstinacy and caution. He was an amazingly healthy man and worked until the year of his death in 1723, when he was ninety-one years of age. And after him came Spallanzani, Pasteur, Koch, Lister, and just twenty-six years after his death Edward Jenner was born in Gloucestershire, England, and now I must pass to a series of events, emphasizing the value of patient and laborious research for truth, showing how medical science has drawn from sources as Holmes affirmed, for relief of suffering and prevention of disease. The physicist, the chemist, the botanist, the psychologist, and the theologian and psychotherapist have all aided in remedial measures. The pharmacist and pharmaceutic manufacturer have made medicine potent and palatable to the patient. "Pink pills for pale people" are more easily taken than were some of the nauseous products of the medieval pharmacy, but we must know the formula for each pink pill and the therapeutic action of each ingredient before prescribing, and the U. S. P. and N. F. furnish ample scope for use and study. One of the great achievements during the last century is the evolution of the U. S. P., and the first suggestion for this work was made by Dr. Lyman Spalding, of New Hampshire, in 1816, and the present revision committee, composed of physicians, pharmacists and chemists, is continuing their important work preparing for the revision.

Discovery of Circulation of Blood and Making an Anatomy

William Harvey was the discoverer of the circulation of the blood. He was born in Folkstone, England, in 1578, and in 1628 he published his "Tradition" shattering book on this subject, which revolutionized the teachings and practices in anatomy and surgery. It is difficult to realize how ignorant man was of the physiology and anatomy of the human body. It has been truly said that the development of modern surgery was prevented by the lack of four essentials more fundamental than manual skill. These essentials are (1) a knowledge of anatomy; (2) a method of controlling hemorrhage; (3) anesthetics to deaden pain; (4) a knowledge of the nature of infection and methods for its prevention. There are only two surgical operations mentioned in the Old Testament, that of circumcision, and the operation on Adam for the formation of Mother Eve, and the idea that a

man had one less rib than women persisted until the sixteenth century, when Versalius showed it to be a myth.

Great Galen derived his knowledge of anatomy from the pig, the ape, the dog and the ox, which led to many errors. It is a long story, that of making an accurate anatomy of the human body—the conflict with the orthodox religions of the various periods, down to the resurrectionists of the past century, even to the present era when my own professor of anatomy at Jefferson was arrested in December, 1882, on the charge of having robbed graves in Lebanon Cemetery, a negro burying ground in Philadelphia. He was tried and acquitted—it being shown that he knew nothing of the manner in which the bodies brought to the dissecting room at Jefferson had been obtained and this suit led to the amendment of the Anatomy Act of 1867, giving to a State Anatomical Board the entire control over unclaimed bodies.

One of the most violent outbreaks against dissection occurred in New York in the so-called Doctors Mob of April, 1788. The physicians had to take refuge in the jail, the militia had to be called out to quell the disturbance and unfortunately seven of the rioters were killed and many more seriously injured.

The resurrectionists were particularly active in Scotland. In 1827 William Hare and William Burke, in partnership, undertook a series of murders to obtain bodies for dissection. Before they were detected they had killed sixteen men and women and disposed of their bodies to the medical school. The method they employed was strangling in order to avoid any marks of violence on the body which might give rise to the suspicion of violent death, and this gave rise to the term of "Burking." In a "Tale of Two Cities," that great novelist Charles Dickens describes the ilk in the person of Jerry Cruncher. "Father," asks Jerry, Jr., "What's a resurrection man?" "Hem! Well," replied Mr. Cruncher, "He's a tradesman." "What's his goods?" asked the brisk young Jerry. "His goods is a branch of scientific goods." "Persons' bodies, ain't it, father?" asked the lively boy. "I believe it is something of that sort," is the reply and he proceeds to urge his young hopeful to "develop" his talents and fit himself for this occupation and so prove a blessing to his father and a recompense for his mother. (But that's another story.) You must read Chapter 14, "The Honest Tradesman," to get the full story of Jerry Cruncher and his nefarious calling as told by a great fictionist.

Eradication of Smallpox

Smallpox or Variola is one of the most ancient virulent of contagious diseases. Its existence in Ancient Egypt is suggested by eruption on the skin of a mummy of the 20th Dynasty (1,200-1,100 B. C.). It was brought to America by the Spaniards in the 16th Century. It was spread by the crusades slowly through Europe in medieval times. The first great epidemic of the disease occurred in London in 1628. It was no respecter of person—the peasant in his hovel and the prince in his palace suffered alike. Charles IX of France had his nose so badly scarred that he seemed to have a double proboscis. Louis XIV, the Grand Monarch, had the disease, and Louis XV died of it. It proved fatal to Queen Mary II of England in 1694, and in the century following her death 60,000,000 persons in Europe died of the "pesta magna" as Galen termed it.

The historian Macaulay, commenting on the death of the queen, gives this description of its ravages: "That disease, over which science has since achieved a succession of glorious and beneficent victories, was the most terrible of all the ministers of death. The havoc of the plague had been far more rapid; but plague has visited our shores only once or twice within living memory; and smallpox was always present, filling the church-yard with corpses, tormenting with constant fear all whom it had not yet stricken, leaving on those whose lives were spared the hideous traces of its power, turning the babe into a changeling at which the mother shuddered, making the eyes and cheeks of the betrothed maiden objects of horror to the lover. Towards the end of the year 1694 this pestilence was more than usually severe. At length the infection spread to the palace and reached the young and blooming queen. She received the intimation of her danger with true greatness of soul. She gave orders that every lady of her bed-chamber, every maid of honor, nay every menial servant, who had not had the smallpox should instantly leave Kensington House."

As previously stated, smallpox was introduced in the early part of the 16th century to America, and in Mexico during a brief period three and a half million people died of this malady. It became epidemic among the American Indians along the New England coast, and it was Cotton Mather who said, "The prodigious pestilence carried not one-tenth, but nine parts of ten (yea—'tis nineteen of twenty) among them: so that the woods were almost clear of these pernicious

creatures to make room for a better growth."—A truly Christian sentiment?

One might digress to discuss this celebrated character, this New England divine, who at once could advocate the use of inoculation in smallpox and recommend the persecution of witches.

Philadelphians are interested in the fact "That the good ship 'Welcome' which bore William Penn to the shores of the Delaware (1682) was attacked by smallpox and about thirty of the passengers died during the voyage."

One finds in Watson's charming Annals interesting references to this disease. Watson informs us that "The happy art of inoculation was first practiced in Philadelphia in 1731; and the first person who then devoted himself as a forlorn hope for the purpose of example was J. Growden, Esq., a public officer of high standing." (Pennypacker in "Pennsylvania, the Keystone State," refers to him as the rival of Andrew Hamilton at the Philadelphia Bar.)

The terror of inoculation was not as great in Philadelphia as in Boston, where Dr. Zabdiel Boylston had inoculated his only son and was mobbed, while Cotton Mather had a hand grenade thrown into his window for advocating this method.

The story of smallpox inoculation is linked with the life of Lady Mary Montagu—the wife of the British Ambassador at the Turkish Court, in the first quarter of the 18th century. She was an interesting character inspiring warm friendships and bitter venomous hatreds. She was unsuccessful in having inoculation introduced into England and vowed that "she never would have attempted it if she had foreseen the vexation, the persecution and even the obloquy it brought upon her."

Inoculation has one great disadvantage—the individual inoculated has true smallpox and although the attack is very mild, nevertheless others may acquire the disease just as they would have from an ordinary case of the disease.

NOTE I—It is interesting to note from Watson—that about 1760 Thomas Jefferson came to Philadelphia on purpose to get inoculated and was placed in a cottage house back from the city near the Schuylkill.

NOTE II—1717 Lady Montagu wrote of the Turkish "inoculation" parties, commonly fifteen or sixteen together—the old woman with nutshell full of matter of best sort of smallpox, etc. Thousands

underwent the operation. The French Ambassador said pleasantly, "that they take the smallpox here by way of diversion as they take the waters in other places."

So the human race had to wait for the advent of Edward Jenner and the introduction of vaccination for relief from the loathsome pest. Jenner was the son of a clergyman (as was Osler, etc.), and was born in a vicarage at Berkeley, Gloucestershire, May 17, 1749. He was a student of the great Scottish surgeon, transplanted to London, John Hunter, to whom he told of the simple country folk saying, "If you've had cowpox you can't catch smallpox." Jenner knew of this tradition, pondered on it—talked to Hunter about it, and elicited that famous reply—applicable to all research workers in all periods of history—*"Don't think, try."* "Keep on experimenting until you find out the truth." (The never ending quest for *truth* has inspired scientific workers in all fields through the ages!)

Smallpox was very prevalent in England at times—ravages of the disease met the eye on every side. Probably three out of five grown-ups you met on the streets of London were marked and disfigured by the disease. Fugitives from justice were more easily identified if the description read—"Free from pock marks," and the Bow Street runners would regard their man as good as caught. Many people considered it hopeless to try to avoid the disease and deliberately came in contact with it to get it over. Jenner after his student days in London returned to Berkeley to the humdrum life of a country practitioner and devoted his study to the foul disease that blighted his country. The story of his success is so well known as to make detailed report unnecessary. He became convinced of the truth of this theory. The doctors of this period were amused and sceptical—amazed at the audacity of a country doctor. He vaccinated his eighteen months old son—the boy he loved best on earth! A touching testimony to his faith in his own discovery.

He experimented—he observed—he reasoned, and in 1798 he wrote that famous treatise: "Inquiry into the causes and effects of the Variolae Vaccine—a disease discovered in some of the Western Counties of England, particularly Gloucestershire, and known by the name of Cowpox." He returned to London for the third time, and all the prejudice and obstruction and jealousy of his opponents were powerless to hold back his discovery. People hailed it with joy and in five or six years the knowledge of it had spread all over the world.

He lived to be rewarded and appreciated. Germany set aside his birthday as a feast day—other countries made it a day of thanksgiving and priests and populace walked in long processions to offer up prayers for the blessing of vaccination.

In 1802 Parliament voted Jenner $50,000 as a national appreciation of his discovery and four years later voted him a further $100,000.

In 1812 a tribe of American Indians sent Jenner a belt and string of wampum—"In token of our acceptance of your precious gift, and we beseech the great Spirit to take care of you in this world and in the land of Spirits."

It seems incredible that anti-vaccinationists can exist—that a man of brains like George Bernard Shaw can blunder so badly in scientific matters. A man may be a brilliant satirist and dramatist and may Narcissus-like worship his own wit and yet be so mentally constituted as to be unable to analyze and comprehend simple scientific truths. One might mention innumerable instances of apparently great intellects with an incomprehensible blind zone.

Philadelphia today without a case of smallpox owes this immunity to the courage of Edward Jenner. Our compulsory vaccination laws are evidences of sound public health sense. The anti-vaccinators for all their kindly feelings are a menace to any country, and I have found none of them is ready to go to our Hospital for Contagious Diseases and aid in treating and nursing the poor victims, for imported cases from extra mural areas occasionally occur in Philadelphia.

As Sir William Osler stated, "I do not see how any reasonable person can oppose vaccination or decry its benefits."

Thanks to Jenner I believe not a single person in this audience is pock marked. A hundred and thirty years ago the faces of more than half of you would have been scarred! The work of Jenner inspired the great Pasteur after more than eighty years had passed to vaccinate a flock of sheep with the attenuated virus of anthrax when every one of the unvaccinated infected from the same material had died. Experimentation saves animal as well as human beings.

Triumphant Discovery of the Contagiousness of Puerperal Fever

Oliver Wendell Holmes is the favorite author of many medical men. He was (as Packard says) an eminent example of the Brahmin

caste of New England as well as the inventor of the term. A medical man can read and re-read his life and his books with keenest interests. His medicated novels, his poems of important, varying types from the September Gale to the Chambered Nautilus which was his favorite, though I wrote it myself he says. His philosophical contributions from the "Autocrat of the Breakfast Table" to "Over the Teacups," written in his eightieth year, "after he had cleared the eight-barred gate" as he humorously termed it, and in this book he shows an abundant infusion of his old-time wit, wisdom and humor. But his medical essays touching on many subjects are of greatest interest to the medical man. In 1838 he was appointed Professor of Anatomy at Dartmouth College, and later—in 1843 he published his greatest medical contribution on "The Contagiousness of Puerperal Fever," in which he vigorously maintained that the disease known as puerperal (or child bed) fever is so far contagious as to be carried from patient to patient by physician and nurses.

He proved his case by a laborious review of relevant literature and by a long catalogue of melancholy histories. His indictment seems absolutely convincing to us with our present-day knowledge of germs and infection! But his views met violent opposition from the leading obstetricians of his day—Hodge of the University of Pennsylvania, and Meigs of the Jefferson Medical College. The latter was particularly abusive and classed Holmes' essay "Among the jejeune and fizzenless dreamings of sophomore writers." Then the fight was on, and as Holmes said, "The expression used in it might well put a stop to all scientific discussions were they to form the current coin in our exchange of opinions."

He reached his greatest height when he wrote—"No man makes a quarrel with me over the counterpane which covers a mother with a new-born infant at her breast," but the tumult and the shouting has since ceased. The advent of bacteriology, the test tube and the microscope have long since vindicated Holmes and his theory, and the two widely known and highly esteemed Professors of their day are almost forgotten, except by medical and collegiate historians.

Another name must be mentioned in this connection, that of Ignaz Philipp Semmelweis, who in 1846 began his study of puerperal infection in the great Allgemaines Krankenhaus in Vienna, declared this fever to be septicemia or blood poisoning. In May, 1847, he prescribed ablutions for his students of chlorinated lime water and re-

duced the mortality in his wards by many points. But his enemies attacked him and his theories and drove him from Vienna and he tragically died in an insane asylum. He was of different type from the great American investigator. One was irascible, impatient and tactless; the other hopeful, altruistic, with a sense of humor that enabled him to fight and laugh at opposition and criticism.

And the battle to reduce still further maternal mortality is being scientifically waged and must be fought until American maternal mortality is as low as any country in the world!

"Yellow Fever Meets Its Master"

The above is the title of a chapter in the Life of William Crawford Gorgas, written by his widow and Burton J. Hendrick. This is the biography of a physician (and many have been written) that a layman may read with keenest interest. The story of that one dread scourge, yellow fever has been told many times.

It formerly occurred extensively in the United States. The epidemic of 1793 in Philadelphia, so graphically described by Matthew Carey was the most serious that ever visited any city of the Middle States—the mortality in four months was 4,041 or over, one-tenth of the population of the city. Epidemics of less severity occurred in many succeeding years in various cities. It is almost an American disease, although Rubert Boyce claimed its existence on the west coast of Africa. The Philadelphia epidemic of 1793 occurred when the city was the nation's capital, though Congress had adjourned, several months before and President Washington, as was his custom, had retired for the summer to Mt. Vernon. "There was scarcely a home that was not afflicted; the rich quarters as well as the poor abounded in the disease, the clean as well as the filthy, and all ages and colours rendered their tribute. In a few days the city was in a state of the wildest disorder. As usual all fled who could get away; for weeks there was a continuous procession of carts, coaches, wagons and 'chairs,' transporting families and furniture in all directions; in the towns to which the refugees went they were most unwelcome visitors, and in many cases they were turned back at the gates. All phases of business and community life came suddenly to an end; banks closed, factories shut their doors, leaving thousands without employment, newspapers stopped publication, and churches ceased their functions for want of congregations. Sick persons sometimes fell dead in the streets, their corpses lying for weeks

without burial. Almost the only occupations were the absurd attempts to check the disease. There was an idea that the 'purification' of the atmosphere would bring relief; to accomplish this bonfires were lighted at every street corner, and cannon were constantly booming. All those who ventured out carried sponges at their mouths, or smelling bottles of vinegar or camphor; not only men, but women, were constantly smoking cigars, for tobacco was regarded as a preventive; while others spent most of their time chewing garlic. A tarred rope was also believed to have protective virtues, and nearly everybody who stepped outdoors carried such a talisman. But personal safety, so it was believed, consisted chiefly in avoiding all human kind. All social intercourse came to an end. One man meeting another on the street would immediately cross to the other side. Friends ceased to be friends and even the closest ties of relationship were ignored. The most distinguished citizens were buried unceremoniously, with no human attendant except the Negro who drove the death cart. The appearance of anything that resembled such a funeral was a signal for the population to flee in all directions. In many cases husbands abandoned their sick wives and wives their sick husbands; instances were not unknown in which parents fled from their children and children left their parents to die in neglect. The afflicted were sometimes left to perish miserably without medicine, or a drink of water, and even women in childbirth frequently received no care. There were, of course plenty of cases of heroism to balance these instances of inhumanity. Stephen Girard, the eccentric millionaire, especially distinguished himself by his devotion to the sick poor; but the abandonment of the city by the prosperous and the terror before an invisible foe that seized the remaining population, left Philadelphia largely at the mercy of the disease. The situation continued until the appearance of frost, when the plague vanished as mysteriously as it had arrived, and the town again adjusted itself to normal conditions."

We pass over the intervening years from 1793 to 1893, and it cannot be said that scientific men knew in 1898 much more about yellow fever than their predecessors of the 18th century.

An Italian bacteriologist, Sanarelli, had indeed isolated a bacillus which he asserted was the guilty agent; but a group of Americans had brought international laughter upon him by showing that this was merely the long familiar microbe of "hog cholera."

Gorgas was sent to Havana in 1898. For the five years preceding that city had been the scene of especially atrocious military operations. The health and welfare of its inhabitants had been neglected. "Unspeakable odors assailed one everywhere. Streets were filled with dead animals, decaying vegetables, miscellaneous sewage and refuse of all kinds," and yet the yellow fever death rate was low, although other diseases prevailed—most of the living inhabitants had had the first disease. Gorgas cleaned up Havana at the end of several months. Scrubbing and burning and disinfection—Havana emerged; a tropical city as clean within and without as any of the proud centers of the temperate zone and the American people loudly gloried in it, but alas a change—a fall of pride was to come. The cessation of the Cuban war had stimulated immigration from Spain. In the year 1900 more than 25,000 immigrants arrived from the mother country. They came from a country in which yellow fever had been unknown—they were all non-immunes. Their debarkations in Havana were like shavings applied to a faintly flickering flame. A new epidemic flared forth—the worst the island had ever known. Havana the "spotless town" of the Caribbean was just as intensely scourged with yellow fever as Havana, the "pest hole"! The pestilence behaved like a grinning spectre, making mockery of all the lessons of sanitary science, all the time concealing the simple secret that would have made everything clear. Gorgas was health officer. General Leonard Wood, the new Governor-General, and these two famous doctors spent many anxious, busy hours devising new ways of combating the ancient enemy. One man had watched the sanitary measures of the Americans with somewhat sceptical interest—in his mind the whole proceeding was absurd as far as yellow fever was concerned. The man was Dr. Carlos J. Finlay, who while a full-fledged Cuban in thought and feeling, was the son of a Scotch father and a French mother, and a graduate of the Jefferson Medical College in Philadelphia. He was the perfect type of the "beloved physician."

In 1881 he had read a paper before a medical Congress in Washington, in which he asserted that yellow fever was transmitted by the Stegomyia Mosquito. He was as certain of this as he was of the movement of the planets, but all he gained by this insistence was the reputation of being a harmless crank. His life is one of tragedy in the history of modern medicine, because he had hit upon one of the greatest discoveries of the age, but had never succeeded in demonstrating

its truth. As Gorgas afterward said, "His work remains a splendid example of medical clairvoyance, a beautiful manifestation of the scientific imagination." Finlay lacked the gift of convincing presentation and he was unable to prove his belief, but he inspired thoughtfulness. The situation became more and more desperate and the Surgeon General of the United States appointed a commission—four men then little known outside of army circles, but now names that stand high in science and should be inserted high in the Hall of Fame.

Walter Reed, James Carroll, Jesse W. Lazear and Dr. Aristides Agramonte. They were the men that solved the baffling mystery with that inescapable finality that sometimes makes science as much a thing of beauty as art itself.

The dramatic picture of Lazear watching an infected mosquito bite his hand while experimenting at Las Animas Hospital, his resisting the impulse to brush it off and permitting it to drink its fill is a scene of heroism unsurpassed in the annals of medical history. He contracted one of the most terrible cases of yellow fever that Gorgas had ever seen and died in his delirium in a little more than a week, a martyr to his beloved science. Carroll was also desperately ill, but partly recovered. Tragic lessons which inspired greater determination in their fellow scientists.

The stegomyia mosquito was proven guilty and doomed to extirpation. It is about the only known mosquito that makes any especial claim to beauty. Its body is marked by a series of silvery half moons, its legs are alternately black and white, and the four brilliant stripes on its thorax distinguish it as the handsomest of its tribe, and "the female of the species is more deadly than the male," for it is only the female that ever annoys beasts or men. The male is a quiet, unobtrusive, decently living insect that does not consume blood, but finds its food among fruit juices and other casual scraps. Dramatic as yellow fever has always been, there is nothing in history as dramatic as its sudden cessation. One can tell here the story of the difficulties on the extirpation of the breeding places of this venomous enemy of humanity—of its battles in the jungle—of the building of the Panama Canal—that pestilential zone—a forty mile stretch—one sweltering miasma of death and disease—that had defeated De Lesseps and of where the great French engineer M. Le Blanc said: "If you try to build the canal there will not be trees enough to make crosses for the graves of your labourers."

The digging of that canal was a question of sanitation—the health of the workers. Thanks to science—of the 55,000 employees, about 13,000 of whom were white, the death per thousand was 8.91 less than the death rate of Philadelphia, which was 12.83 in 1931.

Read the life of Gorgas and the stories of the four men on that immortal commission that detected the devious ways of yellow fever transmission. It was fitting that the Vice-Chancellor of Oxford on conferring upon Gorgas the degree of Doctor of Science should poetically salute him!

"Hail Router of the Plague of Flies!
Hail Isthmian Conquerer true!
Gorgas, to that wise Goddess dear,
The Gorgon death who slew."

Typhoid Fever

In the Civil War 10 per cent. of all deaths were from typhoid. In the Spanish-American War every fifth soldier in our Army fell ill of typhoid, and 86 per cent. of all deaths were from typhoid.

In the Great War almost none! Why? Because in the interval between 1898 and 1914 vaccination against typhoid had been discovered and developed.

Let us illustrate by two great experiments on 8000 and on about 750,000 human beings respectively:

Plymouth, Pennsylvania, a town of eight thousand people, was supplied with water from a reservoir fed by a mountain stream. In the first three months of 1885 one man living on the banks of this stream was ill with typhoid fever. His copious dejecta were thrown upon the snow without distinction. When a warm thaw with rain occurred towards the end of March, the germs of typhoid from the dejecta were washed into the stream. On April 10th an epidemic of typhoid broke out in the town and caused, in all, 1104 cases and 114 deaths.

From September 21, 1917, to January 25, 1918—the figures are official—a period about two weeks longer than the war with Spain, there were, on the average, 742,626 soldiers every day in the camps in the United States. They came from unprotected communities, where autumnal typhoid was rife. Yet during these four months there were but 114 cases of typhoid and five of paratyphoid fever, a milder fever closely resembling typhoid. Had the conditions of 1898 pre-

vailed, there would have been 144,506 cases and about 15,000 deaths.

Why was typhoid almost banished? Because every soldier on enlisting was immediately vaccinated against fever. As soon as this vaccination was completed in these new recruits in the less than five weeks from December 14, 1917, to January 15, 1918, there were only six cases in the three-quarters of a million men. These magnificent results were a direct outcome of laboratory work.

During the Great War the British A-V's did their best to dissuade the soldiers from being vaccinated. Had the soldiers heeded them, thousands of lives would have been needlessly sacrificed. (Keen.)

Conquering of Cretinism

Our knowledge of the functions of the endocrine gland has increased immensely during the past few decades. One of the lectures in this series will be given by Dr. H. C. Wood, on "Glands of Internal Secretion" and their effect upon personality.

The pharmacist and manufacturing chemist is much interested in preparation and protection of these glandular products, demanding such accuracy and conscientious care. Without encroaching very much upon Dr. Wood's lecture I want to tell something of the story of cretinism and its treatment as illustrating one of the great triumphs in medicine.

Cretinism was described by Paracelsus in the 16th century. It is the result of hypothyroidism, a form of idiocy or infantilism, due to absence or lack of secretion of the thyroid gland.

The body is dwarfed—bones are undeveloped—the skin sallow or yellow, earthy, the hair resembles horse hair more than that of a human being, the face a leaden hue, chest narrow, back curved, breath asthmatic, limbs short and misshapen—without power, head dropping listlessly on chest and abdomen like a bag. The adult may reach the mental capacity and intellectual development of a child of three or four years, though more often the standard attained is lower than this, a pitiful little animal, and before 1891 there was no known treatment for this disease. The patients lived in hopeless imbecility until death, and then Dr. George Murray published his discovery of the effects of hypodermic injections of thyroid extract in myxedema, a somewhat similar condition and the remedy was soon after applied to cretinism with wonderful results. The extract must of course be used with greatest care and discrimination.

The prevention and treatment of cretinism had been achieved—the results as a rule are most astounding, and as Osler said, "Unparalleled by anything in the whole range of curative measures." Within a few weeks a poor, feeble, toad-like caricature of humanity may be restored to mental and bodily health.

The field of glandular therapy is a wide one and we are only beginning to realize the extent and value of this form of therapeutics, a type unknown to our forebears in medicine and pharmacy.

Modern researches in physiological chemistry, especially the glandular secretions have revealed the fact that an important part is played by these secretions which contain definite active principles such as suprarenalin, thyroxin, insulin, and pituitrin, etc.

If one is interested in the Doctor in fiction, turn to Balzac's greatest novel, "The Country Doctor," the history of Dr. Benassis. The doctor in the first section of this book tells the story of his arrival in a country district of France.

"When I first settled here, sir, I found a dozen cretins in this part of the canton, and the doctor turned 'round to point out the ruined cottages for the officer's benefit. 'All the favorable conditions for spreading the hideous diseases are there; the air is stagnant, the hamlet lies in the valley bottom, close beside a torrent supplied with water by the melted snows, and the sunlight only falls on the mountain top, so that the valley itself gets no good of the sun. Marriages among these unfortunate creatures are not forbidden by law, and in this district they are protected by superstitious notions, of whose power I had no conception—superstitions which I blamed at first, and afterward came to admire. So cretinism was in a fair way to spread all over the valley from this spot. Was it not doing the country great service to put a stop to this mental and physical contagion? But imperatively as the salutary changes were required, they might cost the life of any man who endeavored to bring them about. Here, as in other social spheres, if any good is to be done, we come into collision not merely with vested interests, but with something far more dangerous to meddle with—religious ideas crystallized into superstitions, the most permanent form taken by human thought."

This book was written in 1833—a century ago, and segregation or deportation to healthier climates was the only known treatment to prevent the spread of the malady.

The Defeat of Diphtheria

This specific infectious disease characterized by a local fibrinous exudate usually upon the mucous membrane of the throat and by constitutional symptoms due to toxins, has been known in the East for centuries and is referred to in the Babylonian Talmud and was first accurately described by Aretaeus in the first century A. D., as paralysis of the palate. A sequel of this disease was recognized by Aetius in the sixth century. Epidemics of this dread disease in Europe in the sixteenth and seventeenth centuries and in England in the eighteenth century, were described by Fothergill and Huxham. It has been said that Washington died of the disease. It had been epidemic for centuries with high mortality, but from the time of Klebs and Loeffler the causative bacteria improved methods of prevention and treatment have developed, first by antitoxin (1895), which reduced the mortality after the disease had occurred. The Shick test of intradermic injection of diphtheria showing immunity or susceptibility to the disease, and finally the glorious triumph of immunization. Today a death from diphtheria is preventable—if it occurs it is due to ignorance or careless neglect. A city the size of Auburn, N. Y., a community of 35,000, has had four years without a single death from this disease, although prior to the beginning of intensive work cases and deaths ran high. The record of New Haven (180,000) almost as good, only one death in a year.

In Philadelphia toxin-antitoxin was introduced in 1917, and since that time the incidence of the disease and the death rate show a sharp decline. In the year 1925, 3887 cases were reported with 315 deaths, while in 1931, 281 cases with 29 deaths.

When you consider the population of this metropolis, heterogeneous type of our people and the problem of popular education of all the parents, this advance is phenomenal. Money expended for public health education brings in the saving of human life!

During the incipiency of this crusade it was necessary to educate and inspire the medical profession as well as the laity.

Philadelphia Leads Nation in Wiping Out Diphtheria, Health Survey Indicates

Use of Toxin-Antitoxin Has Cut Morbidity 95 Per Cent. in Six Years and Mortality More Than 90 Per Cent.

By Louis Lehrfeld, A. M., M. D.

Editor, Weekly Health Bulletin, Department of Public Health

In reviewing the accomplishments of the Department of Public Health during the seventeen years of my connection with the department there stands out

prominently above all other achievements one particular conquest—namely, the control of diphtheria.

I have witnessed the reduction in the death rate from pulmonary tuberculosis by 50 per cent. during the past fifteen years and a similar reduction in the infant mortality. I have seen the typhoid death rate reduced to the lowest in the history of the city. I have witnessed the complete elimination of smallpox. But no activity in public health has shown such miraculous and phenomenal success as the concentrated effort in the elimination of diphtheria as a serious menace to the childhood population.

When diphtheria antitoxin was introduced by the Health Department in 1896 fully 50 per cent. of all the diphtheria cases died. Antitoxin which was then welcomed as an unusual discovery in the control of diphtheria, had its effect after a period of years and reduced the mortality of diphtheria from 50 to approximately 10 per cent.

Cases Fail to Drop

It was found, however, that, while the deaths were fewer in number, the cases did not decline in the same proportion as did the mortality.

It was not until toxin-antitoxin was introduced in Philadelphia in 1917 that the incidence of diphtheria and the death rate showed a sharp decline. Accumulated efforts and the use of toxin-antitoxin made their best showing after the year 1925.

The statistics are as follows:

Year	Cases Reported	Deaths	Date Rate per 100,000
1925.....	3,887	315	16.7
1926.....	2,750	272	14.3
1927.....	2,607	220	11.5
1928.....	1,964	230	11.9
1929.....	969	88	4.5
1930.....	635	48	2.5
1931 (Dec. 30)	281	29	1.5

A hasty glance at these numbers indicates that the morbidity alone has been reduced fully 95 per cent. in the last six years and the mortality rate more than 90 per cent.

No communicable disease, with the possible exception of smallbox, has ever shown such rapid decline as the result of public health efforts. This outstanding record proves conclusively the value of public health work and indicates that the money spent in this direction is a sound investment.

Honor Expected Later

It is quite likely this will be more appreciated in years to come, when those in the Health Department who are directly responsible for the activities in this direction will be honored and the records of their achievements permanently inscribed in stone.

While excellent results are being obtained in other large cities of the United States in the control of diphtheria, it appears that Philadelphia shows the most creditable record and will continue its great work until disphtheria will be as rare as smallpox.

Malaria and Mosquitoes

Malaria—chills and fever—was at one time very prevalent, but in Philadelphia and along the valleys of the Delaware and Schuylkill Rivers, formerly "hot-beds of malaria," the disease has become much restricted. In 1880, Laveran, a French army surgeon, stationed at

Algiers, noted in the blood of patients with this fever pigmented bodies, which he regarded as parasites and as the cause of the disease —Verb. Sap.! This hint started the scientific wizards. In 1885, Golgi made the all-important observation that the paroxysm of fever invariably coincided with the sporulation or segmentation of a group of parasites. Laveran's observations were brought before the profession of the United States by Sternberg. Osler began studying the malarial cases in the Philadelphia General Hospital (Old Blockley), and in a letter to Dr. John Welsh Croskey, historian of Old Blockley, the then Regius Professor of Medicine at Oxford (1918), writes, "My literary output while in Philadelphia came very largely from the Philadelphia Hospital service—the malarial experience was of special value." Osler was a member of the staff of our great city institutions from 1885 to 1889. Judson Daland has had interesting and amusing experiences in studying malaria—the medical cause célèbre of the day.

A host of hunters all over the world were working on this problem. The idea that fever was transmitted by the bite of the mosquito prevailed widely in the West Indies and in our Southern States, but it remained for Patrick Manson, an eminent English doctor, to formulate in a clear and scientific way the theory of infection in malaria by the mosquito. ("The last few years of the nineteenth century were as unfortunate for ticks, bugs and gnats as they were glorious for the microbe hunters," DeKruif.) Theobald Smith had scotched the ticks that carried Texas fever, a disease that caused the death of thousands of cattle in the South. New York City went into panic when carloads of stock shipped East for beef began to die in hundreds on the train, etc. But science intervened and Theobald Smith, the criminal detective, traced out the exact path by which a subvisible assassin goes from one animal to another, and showed men an entirely new and fantastic way a disease may be carried by an insect.

Today whole States are "dipping" their cattle and Texas fever, which once threatened the great myriads of American cattle, is no longer a matter for concern, and the price of roasts and steaks is satisfactory to the housewife and her husband. A little later—and six thousand miles away, David Bruce, stumbling through Africa, got onto the trail of the tsetse fly, accused him, and convicted him. He tripped up and triumphed over the Trypanosome, the cause of sleeping sickness.

Robert de Bruce (1274-1329), King of Scotland, had died of leprosy, a chronic infectious disease caused by the bacillus leprac in 1329. David Bruce chased the tsetse fly to its breeding place, taught mankind its deadly role. (The spider and the fly in history.)

But to return to malaria. We Americans today can scarcely realize the ravages of this disease. In India terrible epidemics have occurred. In the Punjab, in 1908, there were more than three million deaths from the fever. In Africa the malarial fevers form the great obstacle to European settlements on the coast and along the river basins. The scientists longed for the discovery of Manson, who was called by the medical wiseacres of Harley Street—"A pathological Jules Verne." He suspected that mosquitoes carry malaria. He told his theory to Ronald Ross, who sailed to India in 1895 with the blessing and advice of Patrick Manson.

Months of hard work and careful experimentation, but at last he could say, for he was a poetic scientist:

"I have found the secret deeds,
Oh million—murdering death,
I know that this little thing
A million men will save;
Oh, death where is thy sting,
Thy victory, oh, grave?"

While Ross was working Giovanni Grassi was laboring in Italy. People said, "Malaria is the worst problem Italy has to face." "It desolates our richest farms!" "It attacks millions in our lush lowlands!" The country around was notoriously malarious, but after months of work Grassi concluded that only the mosquito that bites a malaria sufferer can give malaria to healthy people.

It is not worth while to tell of the bitter fight for precedence between Ross and Grassi—as some one has said, "The facts of science are greater than the little men who find those facts." The chief fight was against the Anopheles mosquitoes, the assassins of red blood corpuscles, the sappers of vigorous life, the chief scourge of the lands of the South.

The greatest triumph is found in the fertile fields—and the healthy babies of Italy, Africa, India and America where once the hum of the anopheles brought poisoned blood and chattering teeth—desolation and death.

Ronald Ross received a well-merited knighthood and the Nobel prize.

The treatment of malaria (this word was coined by Torti, a prominent Italian physician—literally "bad air," because it was associated popularly with exhalation of marshes), is prophylactic and curative. Preventive measures are: 1st, eradication of mosquito propagation areas by drainage; 2nd, control of areas allowed to exist by larvicides; 3rd, protection by screening of houses; 4th, destruction of adult anopheles. The story of Havana, of Ismalia, and above all the Panama Canal Zone shows what can be done.

In Quinine we possess a specific remedy against malarial infection. The romantic story of Cinchona or Peruvian bark is of deep interest.

"Many new drugs and chemicals appeared in medical practice during this remarkable seventeenth century. Guaiacum and sarsaparilla had been brought from the new world during the previous century and by this time had become firmly intrenched. Jalap appeared as a new drug from Mexico. Cinchona was brought to Europe about 1638 by the wife of Count Chichon, Viceroy of Peru, who had been cured of a stubborn intermittent fever by its use. Its virtues were so quickly extolled that within a few years it was in general use throughout Europe.

Being largely distributed by members of the Society of Jesus, Jesuits, as they were called, the drug came to be called Jesuit's Bark and Jesuit's Powder, Powder of the Cardinal and Powder of the Fathers. It was also called Polvo de Condesa (The Countess' Powder), Peruvian Bark, Peruvian Powder, Fever Bark, Red Bark, Yellow Bark, and similar names of obvious origin.

Its popularity was enhanced by the success of a seventeenth century nostrum, advertised to the public in the newspapers of that period as a cure for fever. It was said of its early history that only laymen, charlatans and semi-professional empiricists were willing to use it. Protestants refused to employ it, because of its association with the Jesuits. At first it was worth almost its weight in gold, for even when used empirically in certain kinds of fevers, its curative effects were marvelous.

Talbot, a charlatan in English medical practice, attained great fame by curing first the daughter of a peer, and later Charles II, who knighted him and appointed him Royal Physician at £100 a year.

Talbot then went to Paris and cured the Dauphin, son of Louis XIV. For this service he received 2000 guineas, a pension of £100 a year and the title of "Chevalier." He then went to Spain, where he cured the Queen (malaria seeming to be a prevalent disease of the nobility at that time), after which he returned to London and died in 1681 at the age of forty.

The greatest handicap to the use of cinchona in regular medical practice, lay in the fact that it upset all schools of medicine of that period, which were based on humors or fluxes. Some of the physicians of that time would rather have died than use a remedy so opposed to the principles of the then existing practice.

Cinchona was the entering wedge that brought about the end of Galenism, which had held undisputed sway for 1500 years. Many physicians of that time would not even use a drug not known or recommened by Galen. Ralph Irving, a later writer upon the subject, says of cinchona: "There are interwoven the story of commercial greed and the efforts of the self-sacrificing pioneer; antagonisms of religious sects and rivalries of nations, distractions bred by medical ethics and personal hatred within professional ranks."

Roentgen Ray

In 1895, William Konrad Roentgen, of Wurzburg, while making a study of cathode rays as developed by Crookes vacuum tubes, discovered the energy which he named the X-rays. The discovery was due to an accident. He had laid an energized tube upon a book, within the book was a key placed there as a marker and the book rested upon a photograph plate holder containing plates. When he developed the plates later he found the picture of a key. It was the "key" to a great discovery. It opened the door of opportunity for further investigation and for the use of this mysterious agency in the diagnosis and treatment of disease. Like radium it has its dangers, and many are the medical martyrs who suffered until the potent effects of this agency were understood and controlled.

Radium and Madam Curie

When Pierre Curie was twenty-two years of age he had written "Women of Genius are rare, and the average woman is a positive hindrance to a serious-minded scientist."

Huntington Cairns' interesting article on "The Woman of Genius" had not then been written, telling of women in mathematics from

Hypatia and Heloise to Charlotte Angus Scott; in astronomy from Saint Hildegard to Maria Mitchell; in natural science from Anna Manzolani to Madame Coudreau. Long ago Montaigne wrote, "I say that man and woman are cast in the same mould," and with changing social conditions it is possible with respect to genius that experience may show us that he wrote with profound intuition. But Pierre experienced a radical change of opinion about women after he met and loved and married Marie Sklowdoska, the young Polish scientist. Read the story in Bernard Jaffe's "Crucibles." It is romantic and fascinating. Madame Curie became the discoverer of "polonium," named after her beloved country, and of radium, an element destined to cause greater overturning of chemical theories than any other element that has ever been isolated, the most potent poison yet known to mankind, even acting from a distance. "I love it, but I owe it a grudge," said Becquerel, for he had received a nasty burn on his stomach from a minute amount of radium in a tube in his vest pocket when he went to London to exhibit this peculiar element to the Royal Society.

A woman had not only pushed back the frontiers of chemical knowledge, she had discovered a new world waiting to be explored. The imagination of the world was kindled. The patient and hard-working Curies became world famous overnight. Honors were thrust upon them. They refused to commercialize the great discovery. Every crystal of radium salt which wrenched from mountains of rock they turned over to hospitals without charge. Even the gram of radium, gift of American womanhood in 1921 was willed at once to the Institute of Radium of Paris for the exclusive use in the "Labratoir Curie." Pierre died (killed by a cab in the streets of Paris), and then France made a wonderful gesture and his widow was asked to occupy the Chair of Physics, vacated by the death of her husband. This was contrary to all precedent. No woman had ever held professorship in the Sorbonne! Tradition was smashed! How one would like to have the scene at her first lecture! In this discovery, chemistry, once more made its contribution to the healing art.

Becquerel in 1896 discovered the peculiar spontaneous emissions of rays from the uranium salts. In 1897 Madame Curie began her experiments, and in 1898 she discovered the existence of polonium and radium, and in 1907 obtained the new element in the state of metal. This element is of distinct value in the treatment of malignant disease,

employed alone or in combination with other measures. The Philadelphia General Hospital is fortunate in having an adequate amount of this precious product for therapeutic purposes. The treatment of cancer will be more or less unsatisfactory until the specific cause is determined, but when the cause is determined, treatment will be soon discovered.

I am optimistic enough to believe that with trained scientists working in well-equipped laboratories all over the world, that the day is not far distant. That will be one of the greatest *Triumphs in Medicine!*

Diabetes Mellitus

This disease was known to Celsus and named by Aretaeus. We know today it is a metabolic disease in which the normal utilization of carbohydrate is impaired with an increase in the sugar contents of the blood and consequent glycosuria—Today we know that this disease is due to failure of the part of the pancreas to pass into circulation its internal secretion, which comes from those little islands or glands so small that they could only be detected by the microscope and named after the Christopher Columbus who discovered them the Islands of Langerhans.

"The diabetic who has the severe type of the disease, owes his chance to live to Dr. Frederick G. Banting, the discoverer of insulin, which is the active, internal secretion of the Islands of Langerhans.

Dr. Banting returned from the World War a real hero, and opened an office thoroughly equipped with the latest instruments to practice his specialty, orthopedic surgery.

His quiet ethical or orthodox medical ways did not immediately attract a lucrative practice, so he obtained work in a physiological laboratory and was soon seeking the elusive insulin for which many scientists before him had earnestly searched.

He reviewed their tests and then formed a theory of his own upon which he labored many months. His finances being exhausted, he sold his office equipment at a sacrifice that he might continue his labors.

During his five years of war service he had been decorated for bravery and had had the stimulating thrill of high heroism.

This thrill of sacrifice still inspired him to labor for humanity, and after many tedious trials he brought forth insulin.

It is the beginning of a new epoch and the finger of medical history has already written this young man's name in her book of ages. After the research work on diet, we needed only insulin to place diabetes far above all other diseases in the scientific accuracy and mathematical exactness of its treatment. The dramatic results when diabetic coma is properly treated with insulin entirely outrival the ablest efforts of our most skillful surgeons; in truth, it is almost bringing the dead back to life!

However, in the scientific sense, insulin does not cure diabetes. Neither Dr. Banting nor those chosen to study it clinically so consider it. It is recognized as a help or an aid to those whose diabetes is of such severity that a careful regulation of diet will not keep them in good health and enable them to maintain their efficiency.

Diabetes is on the increase in the United States. Osler suggests this may be due to a great increase in the consumption of sugar.

Tetanus

Tetanus or Lockjaw is an infectious malady characterized by tonic spasms of the muscles with marked exacerbations. The virus or poison occurs in earth, in putrefying fluids and manure. An extraordinary number of cases have followed the accidents of the July 4th celebrations. The toy pistol caused large percentage of cases—a tragic price to pay for patriotic enthusiasm, and a powerful argument in favor of a quieter and saner Fourth of July observance. A knowledge of the cause of tetanus has lead to its prevention and scientific treatment. As Da Costa has wisely said, "Far better than to treat tenanus well, is to prevent it." Every infected wound must be disinfected with scrupulous care, and every puncture must be incised to its depth and thoroughly cleaned and drained. In tetanus antitoxin we have a prophylactic measure which merits our fullest confidence. War experience on a large scale proves this fact. In the British army active in the World War after universal immunization was introduced, the ratio of cases of tetanus fell from 32 per 1000 to 2 per 1000, and similar corroboration from many sources can be cited.

Read the report of Major General Sir David Bruce, on tetanus in the World War, out of 1,242,000 wounded men who were sent home to England, 1,458 cases arose, giving a ratio of rather more than 1 per 1000. In September, 1914, the ratio of tetanus cases due to wounds was 9 per 1000.

In October, 1918—four years later, the ratio was .05 per 1000, or 1 in 2000—a striking decrease proving the efficacy of anti-tetanic serum. The same experience was met with in French, German and American armies as soon as preventive inoculation became the universal practice.

It is impossible in one lecture to review all of the achievements of medicine and pharmacy, even during the last decade. To cite a few:

The work on vitamins has been of vast importance to the human race.

The value of ultra irradicated food has found a place in the formation of healthy bones and teeth in children.

In 1928 the Noble Prize for Chemistry was awarded to Dr. Adolph Windaus of Goettingen, Germany, for his part in experiments proving that ultra-violet light, either in sunlight or artificially produced will activate ergosterol and confer on it antirachitic properties.

The use of liver extract for anaemia—and dried hog stomachs were discovered to have a distinctive value in this condition.

One of the notable achievements was that of Prof. John J. Abel, who was the first to isolate pure crystalline insulin.

The isolation of the hormones of the pituitary gland.

The possible isolation of a group of micro-organisms believed to be the causative agents of influenza has been claimed by Dr. Isadore S. Falk.

A hormone from the cortex of the suprarenal glands has been isolated by Drs. W. W. Swingle and J. J. Pfiffner at Princeton University to be used in the treatment of Addison's disease.

One notable instrument—the official lung or respirator was invented by Drs. Philip Drinker and L. A. Shaw, of the Harvard School of Public Health, to keep alive patients whose breathing muscles are paralyzed in infantile paralysis, or who are victims of gas poisoning.

Among other triumphs of medicine that I cannot deal with specifically are—the recent developments in the diagnosis of the treatment of tuberculosis. Early in the study of this disease auscultation and the use of stethoscope were important. Now the microscope and X-ray are valuable adjuncts.

Surgery of the chest has developed to a marvelous degree.

The instrument of Dr. Chevalier Jackson in removing foreign bodies from the bronchial passages also presents ultimate possibilities of draining infected cavities in the lung. "Peanut candy is often fatal to babies. Watermelon plus a mother's carelessness has killed many a child. Safety pins have killed more babies than have firearms. Small toys are fraught with danger to small boys—and to small girls. A button box is a dangerous plaything for children; so is a string of beads."

The story of syphilis—606 experiments. Experiments of Ehrlich, which lead to a more satisfactory method of treating this dread disease.

The story of leprosy which prevailed in Egypt 4000 years before Christ, and which required 20,000 leprosy asylums in Egypt during the Middle Ages, has found satisfactory treatment.

"Science is like Captain Cuttles watch, it has to be put forward at frequent intervals, so that it may be correct."

The triumphs in surgery alone would require a special lecture for their consideration, and I may be tempted to give it at some future time.

"It is the glory of God to conceal a thing, but the glory of a king to search it out."—(Solomon.)

> For even the things which be in our hands,
> These, knowing, we know not—so far from us,
> In doubtful dimness, gleams the star of truth.
>
> —*Anon.*

ABSTRACTED AND REPRINTED ARTICLES

THE PERMANENCE OF ARTISTS' MATERIALS*

By Noel Heaton, B. Sc.

President, Oil and Colour Chemists' Association

I HAVE been honoured with an invitation from the Council of the Society to put before you my views on this subject, which is of far reaching importance to the arts, and I must begin by expressing my conviction that the main cause of the uneasiness so generally felt as to the permanence of modern paintings is the decline of craftsmanship. I use the word in the sense of knowledge on the part of the artist of the possibilities and limitations of the materials he uses. The permanence of an artist's work is dependent not only on the durability of the materials he employs, but on his knowledge of *how to use them* to the best advantage—I would almost go so far as to say that the modern system of painting and of modern art education, considered from the technical point of view, is unsound. In making this somewhat sweeping statement, I would emphasise that I speak purely from the point of view of one who has made a study of the technical principles on which painting is based. I make no claim to be qualified to discuss, still less to criticise, modern paintings from the aesthetic point of view. Before I attempt to justify this opinion, I would like to clear the air of some misconceptions on this matter of permanence or durability which I have found sufficiently prevalent to confuse the issue, although you may perhaps consider them obvious.

My first point is that permanence or durability is a relative term—it is influenced by a number of factors and it is only in a few exceptional cases that we can refer to any material as permanent without any reservations. If this is the case with the individual materials used by the artist it is still more so with the paintings themselves, the durability of which depends largely upon the conditions to which they are exposed.

In industrial painting, whereas it is considered that the normal life for a paint exposed to the weather is five years, the same paint used

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indoors, where it is protected from direct weathering, will last many years. The same principle of relative durability applies in the case of works of art, although the circumstances are different. They are normally protected from weathering, but durability has to be considered in terms of generations instead of years.

To illustrate my point, I have here a fragment of a painting on plaster found at Meydum, executed in the reign of Snefern some four or five thousand years ago. The painting has remained in substantially sound condition to this day, but you will notice that on one corner of the specimen the paint has disappeared, leaving the white plaster. I removed it myself, by lightly rubbing the surface with a damp cloth. The pigments used are perfectly durable, but they are only bound to the surface with gum—it is, in fact, nothing more or less than a water colour painting. A painting on plaster executed in this manner would not last very long in our damp climate without protection. The reason it has lasted so long is that it was executed in a tomb, in the dry climate of Egypt, protected from light, damp and impure air and sealed from any possible agent of destruction.

One frequently sees references to the discovery of such ancient works of art, with the comment that they were as fresh as the day they were painted, coupled with the suggestion that such permanence cannot be attained with the materials available nowadays. Before accepting any such suggestions we must examine the conditions under which such paintings were executed and preserved.

An incident which occurred to me barely a year ago provides a further illustration of the same point. I was studying the illuminated MSS. at the Exhibition of Persian Art at the Royal Academy last winter, and close to me there was an artist—a well-known artist—accompanied by a lady. Both waxed enthusiastic over the brilliant colouring and wonderful state of preservation of the illumination, and the lady asked "Why is it that modern paintings do not last like this?" Her companion explained in reply that it was impossible to obtain the pigments they used nowadays, "their production is a lost art, and the pigments we use today are made from aniline dyes, which do not last."

I will comment on the accuracy of this statement shortly, but for the moment my point is that such book illustrations provide almost ideal conditions for preservation. Only the minimum of vehicle is needed to attach the pigments to the surface, and their colour and brilliancy are developed to the fullest extent. The book is normally

kept closed, and the paintings are automatically shielded from light and air and every source of injury. Under such conditions many brilliant but fugitive pigments can be used with safety which it would be disastrous to employ in a water colour painting which has to be continually exposed to daylight. Let us bear in mind, therefore, that the permanence of works of art is materially influenced by the conditions of exposure to such things as sunlight, variations of temperature, variations of humidity, dirt, impure air, etc. Nor must we overlook the fact that the problem of preservation is far greater today under the corrosive atmosphere of modern urban conditions than it was in past times.

I hold it a fallacy to suppose that *every* ancient mediaeval work of art was more durable than any modern painting. The old painters developed their methods by a laborious process of trial and error, and the many failures which resulted have long since disappeared, only the masterpieces remaining. But the very limitations imposed by that laborious process tended to eliminate the mediocre and developed a tradition of sound craftsmanship.

There is no foundation for the belief that materials were available in ancient times of which we have no knowledge. I do not believe there is a single pigment or other raw material used in ancient or mediaeval times which could not be reproduced today if necessary, although there are many that have dropped out of use for reasons which I shall indicate. What is sometimes difficult to elucidate is the details of their craftsmanship, the subtle methods of manipulating their materials on which the permanence of their work so much depended—methods elaborated by a combination of experience of the materials they used, shrewd observation and abundant common sense: methods that were probably handed down verbally as treasured secrets and of which there are consequently no records. It is true that many documentary accounts of such methods have come down to us, but invaluable as these are I would venture a caution as to the care needed in interpreting them. It is difficult enough for us, with all our resources, to convey such information accurately in writing, but in the days of empiricism it was almost impossible, and the absence of any recognised nomenclature makes it sometimes difficult to identify the processes described with any certainty. We are not entirely free from such confusion in the use of technical terms today. I find, for instance, that the terms "pigment" and "paint" are often used as synonymous

terms by artists, which, whilst perhaps etymologically correct, causes misunderstanding. If you will pardon me for being very elementary for a moment I would like to define clearly my use of these terms, because the distinction between pigment and paint is fundamental to my argument.

Amongst paint chemists, a pigment is understood to be a substance which is suitable for decorative purposes on account of its pronounced colour, and which can be prepared in the form of a fine powder. In order to attach such pigments to the surface to be decorated it is necessary to mix them with some adhesive substance, known as the "vehicle" or "medium." When a pigment is thus mixed with vehicle, or "tempered" as they used to call it in the old days, the combination of the two is defined as a paint. The importance of this distinction lies in the fact that the permanence of a paint is quite a different thing to the permanence of the pigments contained in it. It is possible on the one hand to combine a perfectly durable pigment with a vehicle that is readily destroyed, so that the resulting paint has no permanence. On the other hand it is possible to prepare a durable paint from a pigment that is by itself decidedly lacking in permanence, by combining it with a suitable medium.

In addition to the pigments and mediums used, the permanence of a painting also depends on the ground to which the paint is applied. Our enquiry resolves itself therefore into three main factors, which are closely interwoven and interdependent—the pigments, the vehicles, and the surface to be painted.

Pigments

To consider first the pigments, I think the incident I have related above, which I can assure you is only one of many which have come within my own observation, provides some justification for the suggestion I made at the outset as to the prevailing lack of knowledge of artists' materials. Nothing could be further from the truth than the statement that the pigments used in past times were more permanent than those available today. It is really pathetic that such ideas should persist in the face of all the efforts that have been made in recent years to provide the artist with accurate information on the subject. I may refer, for instance, to the work of the late Sir Arthur Church, and would like especially to pay a tribute of respect to the untiring efforts of Professor A. P. Laurie on behalf of the artist. As far back as

1891* Professor Laurie demonstrated in this room that one of the most wonderfully preserved paintings of the Old Masters we know contained pigments, such as verdigris, which have been largely discarded in modern practice on account of their unreliable character. I would say, quite deliberately, that at no time since the days when Neolithic man first began to use pigments has the artist had at his disposal so many reliable pigments as he has today. I have endeavoured to give a bird's eye view of the situation in the accompanying Table.

When primitive man developed the craving to depict the objects around him he was limited to such pigments as he found around him in nature. These mineral pigments or earth colours have remained in use ever since and provide the nearest approach to absolute durability we possess.

The first pigment to be prepared by artificial means was the Egyptian Blue, which became a regular article of commerce in the XII Dynasty, and the next to be introduced in order of date was probably white lead. From time to time fresh materials were pressed into service, and at the dawn of our era a large number of pigments were in use, many of which have since been discarded as unreliable. Additions of a similar character continued throughout mediaeval times, but towards the end of the eighteenth century chemistry began to develop rapidly as a systematic science and since then many new and reliable pigments have been introduced, which I have shown in the Table with the approximate date of introduction. The first great advance was made with the production of Prussian Blue in 1700, but perhaps the greatest triumph of chemistry in this direction was the synthesis of Ultramarine in 1830 by Gmelin in Germany, and Guimet in France. The last modern pigment to be introduced was Titanium Oxide, which I had the privilege of describing to the Society ten years ago.†

But whilst this development was taking place, art and science were not co-ordinated. The artist was gradually losing the traditional knowledge of the old painters and the chemist was not yet in a position to understand his requirements. Substances continued to be introduced as pigments without due consideration of their durability, everything being sacrificed to the immediate result. With the introduction

*The Durability of Pictures Painted With Oils and Varnishes.—*Journal of the Royal Society of Arts,* April 10, 1891.

†The Production of Titanium Oxide and Its Use as a Paint Material.—*Journal of the Royal Society of Arts,* June 23, 1922.

Date of Introduction.	Inorganic Derivatives of Metals		Organic Derivatives of Carbon.	
	In Current Use	Obsolete	In Current Use	Obsolete
Neolithic	Carbon Black Yellow Ochre Iron Oxides Red Ochre			
Bronze Age		Egyptian Blue Malachite Orpiment		
Roman	White Lead Vermilion Terreverte	(Red Lead) Azurite Verdigris	Madder Lakes	Tyrian Purple Kermes Woad Indigo (Dragon's Blood) Weld Saffron
Early Mediaeval	Umber Sienna			Lac Lake (Quercitron Lakes)
	Natural Ultramarine	Verditer		(Gamboge) Logwood
XV Century		Naples Yellow		Sap Green
XVI Centry		(Smalt)	(Carmine) (Crimson Lake)	Mummy
XVII Century			Vandyke Brown	(Bitumens)
1700	Prussian Blue			
		King's Yellow	Sepia	
				(Bistre)
1778		Scheele's Green		
1781		Turner's Yellow		
				Indian Yellow
1802	Cobalt Blue			
1814	Emerald Green			
1820	Chrome Yellow			
1829	Cadmium Yellow Zinc Oxide Potter's Pink			
1830	Ultramarine			
		Brilliant Scarlet		
1835	Cobalt Green			
1840	Viridian			
1856				(Mauve Lake)
1859				(Magenta)
	Cobalt Violet			
1861	Aureolin			
1862	Chromium Oxide			
1870			Alizarine Lakes	
1910	Cadmium Scarlet			
1920	Titanium Oxide			

of the synthetic aniline dyes, in the middle of last century, and the temptation to use the brilliant but extremely fugitive lakes obtained from them the position of the artist's palette began to cause serious uneasiness. The Royal Commission of 1863† advised the Royal Academy as follows:

> "That chemistry as applicable to art should be taught, and that there should be a chemist and a laboratory attached to the Academy—colours and vehicles being submitted to practical tests, and variously and publicly exposed to the action of the atmosphere, light and time, and that the results should be carefully registered, made generally accessible and published in the annual report of the proceedings of the Academy."

From that date the pigments in use by artists have been subjected to a constant process of overhauling and pruning, the subject being especially investigated in the classic report of Abney and Russell in 1888.*

You will note from the Table that many pigments, even some of modern introduction, have been swept away since then, notably those treacherous pigments of the bitumen class which wrought such havoc in the paintings of the early nineteenth century.

The pigments given in the Table are classified into those in current use and those which either have been or should be discarded on account of their unreliability. I have put in brackets in the "obsolete" column such of these unsafe pigments as are still obtainable by those who wish to use them. In preparing this chronological list I checked my information from every available source, and whilst the dates can only be fixed with any precision for those discovered within about 200 years, the period of introduction is substantially accurate.

On putting the data together it became clear that they bore out the suggestion that the secret of the "old masters" of the mediaeval period was not the pigments they used, but the way they used them. They inherited the earth colours of ancient times, together with the pigments introduced by the Romans, which included a number of organic substances. They added a number of other pigments of animal and vegetable origin which have been discarded in modern practice as unreliable, and the only substantial addition to the list of permanent

†Report of the Commission appointed to inquire into the Present Position of the Royal Academy, 1863.

*Report on the Action of Light on Water Colours, Science and Art Department, 1888.

pigments during the mediaeval period was the blue obtained from lapis lazuli, which is now practically superseded by the equally reliable synthetic ultramarine.

You will notice that in this list I have divided the pigments into two main groups—the inorganic substances, which are of mineral origin, and the organic substances, which are of animal or vegetable origin. These may be further classified thus:

INORGANIC. Compounds of metals	Natural—prepared from minerals and ores (Earth Colours).
	Synthetic—chemically prepared metallic compounds.
ORGANIC. Complex compounds of carbon	Natural—extracted from animal or vegetable substances.
	Synthetic—dyestuffs precipitated on a mineral base (Lakes).

Broadly speaking, organic substances are fundamentally less durable than inorganic substances, more particularly as regards the fading effect of light, and it is a sound principle to restrict their use as far as possible in paintings required to be permanent. They cannot be avoided entirely, because no inorganic substances have yet been discovered which will provide all the colours required, notably the brilliant crimsons and purples. Of all organic pigments the most reliable are the madder lakes, but even they do not compare in fastness to light with such substances as chromium oxide or ultramarine.

I am not suggesting that all inorganic pigments are more than *relatively* permanent. The nearest approach to absolute durability is found in the natural minerals or "earth colours," but such artificial pigments as are prepared by a process of calcination vie with them in permanence, notably cobalt blue and the oxides of chromium and zinc. The remainder I should describe as "permanent with reservations," and the nature of the reservation differs in individual cases. For example, Chrome Yellow and Cadmium Yellow are both permanent within limits, but have certain weak points which lie in quite different directions. It is impossible to discuss the composition and properties of each pigment individually in the time at my disposal, and the infor-

mation is readily available. For some time past, for instance, artists' colourmen have adopted the sound course of issuing notes on the pigments contained in their paints, with an indication of their composition and durability. I would stress the point that a study of such details is essential to the artist who wishes to ensure the permanence of his work; it is just such knowledge as to the limitations of his materials he uses that I would include in the term "craftsmanship."

To pass to another point, whilst the permanence of a pigment depends primarily on its chemical composition, it is influenced materially by its purity and the physical condition resulting from the method of production. If a substance is fundamentally unsound by composition, nothing on earth can make it reliable, but the converse is unfortunately not true. In this respect modern practice, particularly the developments of the past few years, is to the advantage of the artist. In ancient times pigments were prepared *chiefly* for the use of artists, who prepared their own paints; in fact, there is evidence that in the early days the artist had even to prepare his own pigments, for the simple reason that there was no one to do it for him. They were made in small quantities by empirical methods and were variable in purity.

In modern times the production of pigments has developed into a highly specialised industry and the consumption for artists' use is only a very small fraction of the total. Many of the industrial users of pigments are far more exacting in their demands for purity and uniformity than the artists' colourmen; in the industrial paint industry, for example, most firms now employ chemists to investigate the quality of the pigments they use and consequently production is maintained at a far higher level of efficiency than in past times. It is only in recent years that systematic efforts have been made to investigate the many problems which have been revealed as a result of the increasingly stringent demands for reliability. The Paint and Varnish Society, formed twenty-five years ago, and its present development, the Oil and Colour Chemists' Association, has steadily fostered the technical study of pigments, and for the past five years the paint manufacturers have maintained a very efficient Research Association for the systematic investigation of such matters.

I maintain, therefore, that as regards pigments the artist of today is far better served than ever before. Modern pigments are by no means as perfect as we might desire, but they are as good as they ever

have been. Different pigments vary in their properties and permanence, but those differences are inherent and inevitable. They cannot be made "fool proof" and it will always be necessary for the artist to know something about their properties and limitations if he is to use them to the best advantage to the permanence of his work. Many pigments of a fugitive character are, of course, made at the present time for purposes where permanence is not required, but they are not intended for artists.

The durability of pigments is influenced considerably by the process of painting employed. Apart from exceptional conditions of exposure, such as the illuminated manuscripts I have mentioned, where the greatest protection is given to the pigments, a painting executed by the process known as Encaustic, in which the pigments are embedded in wax, insulates them from the action of air and moisture and allows the use of those of inferior durability. Oil painting also protects the pigments in the same way although to a lesser degree, and in diminishing order of protection we have tempera, water colour and pastel. In the two latter the fading effect of light and air becomes a serious consideration, and the use of organic pigments must be restricted as much as possible.

A further limitation of the range of pigments is introduced in methods of painting which involve exposure to caustic lime and alkalies, such as fresco, and particularly stereochrome (water glass painting). On the other hand, the mediums of organic composition which give the greatest protection to the pigment obscure to the greatest extent their brilliance and luminosity, and if it were possible to use pigments alone in painting without the necessity of adding some medium to bind them to the surface one could utilise them to the greatest advantage from this point of view.

Vehicles

The simplest method of fixing the pigments is to mix them with a water soluble organic substance such as gum or size. This is, in essence, water colour painting, which is perfectly durable so long as it is protected from moisture and care is taken to exclude pigments fugitive to light. This method has been in use from the very earliest times and was in general use in ancient Egypt. A more permanent method of painting was developed during the Bronze Age in which no organic vehicle at all was used, the pigments being merely mixed with

water and applied to a freshly plastered wall surface. This process, which we know as Fresco, gives the greatest value to the brilliance and luminosity of the pigments and is remarkably permanent in pure air. Its weak point lies in the plaster ground itself, which is sensitive to attack by the acids present in impure air, and the process makes extreme demands on the craftsmanship of the artist.

The use of wax as an organic vehicle was introduced in the late Greek or early Roman epoch. In this method, which we know as Encaustic, the pigments are mixed with melted beeswax, the paint so made being applied either with a brush or with the heated metal spatula known as "Cauterium." This method of painting is extremely durable, as is evident from the examples discovered at Hawara by Sir Flinders Petrie.*

It continued in use in early mediaeval times, and forms a quite practicable method for modern work, but the necessity of keeping both the paint and the painted surface hot during execution would make it irksome for general use.

As the skill and ambition of the artist increased he cast about for vehicles to mix with his pigments which would allow him greater latitude, and at the same time secure the greatest possible durability. And so in course of time we come to the use of emulsions to mix with or "temper" the pigments, which provided the Tempera painting characteristic of the thirteenth to the fifteenth centuries. Many types of emulsions were experimented with by different artists, all of which were dependent on the main principle of rendering an insoluble organic substance, such as an oil, *miscible with water* by combining it with a soap or glue.

The most common tempera medium is the natural emulsion found in yolk of egg, but artificially prepared emulsions, such as the saponified beeswax, glue and oil described by Le Begue, were introduced at different times.†

Stress has often been laid on the possession of wonderful secrets in the way of vehicles, particularly by the mediaeval Flemish painters, but from the point of view of permanence there is little to choose between the various types and modifications of emulsions employed. It was the high concentration of pigment in the paint and the meticulous method of execution which was mainly responsible for their successful experiments.

*W. M. Flinders Petrie. *The Hawara Portfolio*, 1913.
†Mrs. Merrifield, *Arts of Painting*. Vol. I, p. 307.

The paint obtained by mixing pigments with such vehicles is freely miscible with water, but when the water dries out after application it becomes quite insoluble. The evaporation of the large proportion of water present in the vehicle results in a dry paint film containing a large proportion of pigment and the film is thin and without any gloss. The painting has to be built up gradually, and owing to the absence of any "flow" crosshatching or stippling is necessary, whilst retouching is difficult owing to the rapid drying. Tempera therefore imposes decided limitations on the artist and demands considerable technical knowledge, as the paints cannot be kept but must be made up as they are required. The pigments used must be carefully studied and where fugitive pigments have to be employed, as was the case in mediaeval times, precautions must be taken to protect them by means of varnish.

The old masters were always experimenting to overcome these limitations, and towards the middle of the fifteenth century they appear to have started experimenting with the use of the so-called "drying oils," such as walnut oil, poppy oil and linseed oil, the peculiar properties of which had long been known. The original use of these was in the preparation of varnish, and they were first introduced as paint vehicles—at least that is my opinion—as an accessory to tempera painting, as glazes to protect unreliable pigments. Used in this way they were of valuable service, particularly to men who knew how to utilise them to the best advantage. For at this time craftsmanship in painting was at its zenith—it was at this period that Van Eyck painted the picture of Arnolfini and his wife, one of the most wonderful pictures, from the point of view of permanence, that has ever been painted.

When painters discovered the facility of execution obtained by the use of oil, its use rapidly extended, and from being an accessory it became more and more employed as the principal medium. When it first took the place of emulsions as a vehicle, the technique of tempera was continued in the main, as one can see in the work of Vermeer, for example. Whilst the necessity for stippling and crosshatching was obviated, the paint was still applied in thin films, and the picture built up in the manner of the tempera painters. Gradually, however, as the traditions of the old tempera painters died away their painstaking methods were discarded: the facility of the oil medium, which obviated all the limitations of the earlier methods, encouraged the development of the more rapid and more expressive method of execution characteristic of the later schools.

Oil paint is exceedingly tractable and the paint remains open long enough for alterations and corrections to be made at will. It would seem at first sight that it provides the ideal vehicle, but it was just this very facility that proved a snare, for it removed the necessity for the artist to prepare his own materials and paved the way for the lack of interest concerning the technical problems involved in their work, which is so prevalent amongst artists of modern times. If only artists would realise, as I am confident the men who introduced it into painting realised, that the oil vehicle requires just as much understanding and care in use to ensure the durability of work executed with it as any other vehicle, I do not think there would have been so much ground for the concern that has been increasingly manifest for about a hundred years past over the durability of modern paintings. The advantages of the oil medium are many and obvious, but I will try to explain the limitations and defects which are inherent to its nature.

A water colour or tempera medium dries owing to the evaporation of the water, and when this is all gone the pigments are left bound by a comparatively small proportion of adhesive, and very little further change occurs. The unfortunate application of the term "drying" to oils conveys the impression that a similar action takes place when they are used. But the so-called drying of such substances as linseed or poppy oil is far different to this familiar process of drying by evaporation. On the contrary it is a process of absorption. The drying oil has the property of absorbing oxygen from the air, and in so doing suffers a complicated series of chemical changes, as a result of which many things happen. It appears to "dry" because as a result of this process the oily liquid first changes into an elastic solid, but there is no evaporation, the proportion between pigment and oil in the dried film remained substantially the same as when the paint was applied. If you dilute a tempera paint with water to make it work freely this disappears on drying and the proportion of pigment in the film is just the same as if the paint were used stiff. But if you add more oil to the paint to make it work freely that oil remains in the dried film and reduces the proportion of pigment—and the more you swamp the pigment with oil the more pronounced become the subsequent results of this chemical change. For when the oil paint has become dry to the touch that is not the end of the matter. The chemical change in the oil continues, although at a decreasing rate, and the film of paint suffers continual change, becoming harder and more

brittle as time goes on, until in time, which will vary from a few years to centuries according to the conditions of exposure, it loses entirely its adhesive properties. It is true that this change is exceedingly slow in the case of pictures, but it is there none the less and it is accompanied by other changes.

In the first place, the formation of the film is accompanied by volume changes, the oil expanding during the initial stage of drying, until it is dry to the touch, when a shrinkage in volume commences, and continues at a gradually decreasing rate for a considerable period. The results of these movements in the film is that if the paint is put on thickly and of uneven thickness, strains are set up and cracking takes place as the film shrinks on hardening. Moreover, as the hardening of the film is due to absorption of oxygen from the air, if the paint is applied in thick masses, as in impasto, the exposed surface hardens and hinders the air from reaching the underlying portions with the result that the paint becomes "case hardened"—hard on the surface, but remaining soft underneath for a considerable time.

As these changes progress, the oil also steadily darkens in colour with resulting loss in the contrast and luminosity of the painting. A most striking object lesson of this discoloration effect in oil painting is to be found by comparing the two paintings by Herbert in the Peers' Robing Room at the Houses of Parliament, popularly known as the "Moses Room" from the striking picture of "Moses bringing down the Tables of Law." This picture was executed by the stereochrome or water glass process, in which no organic vehicle is employed, the companion picture being painted in oils. I think I am right in saying that when first painted these two paintings were in the same key and of equal luminosity, and no one who looks at them today can fail to be struck by the change that has taken place in the "David" painting as compared with the "Moses."

Professor Laurie has recently* drawn attention to a more subtle effect of the changes in the oil vehicle on ageing, by demonstrating that the density of the film increases with age. The density of any substance is a property as inherent to it as the fact that water is wet, and the density of different substances varies enormously. Light pass-

*A. P. Laurie. "On the Change of Refractive Index of Linseed Oil in the Process of Drying, and Its Effect on the Deterioration of Oil Paintings." *Proceedings of the Royal Society*, A. Vol. 112, 1926.

*A. P. Laurie. "Experiment on the Yellowing of Oil Films and on the Change in the Refractive Index of Linseed Oil During Drying." *Journal of the Oil and Colour Chemists' Association*, No. 73, July, 1926.

ing from one substance to another that differs from it in density is deflected out of its course, a phenomenon called "refraction," the degree to which this takes place being proportional to the difference in density between the two. The extent to which a beam of light passing from the air into any substance is refracted forms a useful method of defining its density, as it can be accurately measured and expressed by a figure known as the "refractive index" of the substance. The practical bearing of this on our inquiry is that the opacity of a paint made by dispersing a pigment in a drying oil depends on the difference in density or refractive index of the oil and the pigment. Pigments with a low refractive index, such as a Madder Lake or Prussian Blue are practically transparent in oil—those with a high refractive index, such as White Lead or Vermilion, are opaque or "solid"—they obscure the surface on which they are painted. It has been a frequent subject of comment amongst artists that paint made with these opaque pigments seems to lose its opacity with age, with the result that the balance of the painting is altered and its contrast diminished. In some cases under-paintings which were originally entirely hidden by solid painting gradually become revealed as a consequence. This is not really due to any alteration in the pigment, but to the fact that the oil increases in density as time goes on. Consequently the difference in density between the oil and the pigment is diminished and the opacity of the latter is reduced. The effect of this is particularly noticeable with pigments whose density is such that they only have slight opacity in oil. Raw Sienna and Cobalt Blue, for instance, appear to darken in time, without any real change taking place in the pigment. An understanding of this property of the oil medium is of great advantage to the artist because it can be obviated by manipulation of the painting, or even taken advantage of so that its effect is to preserve rather than impair the colour contrast.

Another point about the oil medium is that being chemically active it is by no means inert to the pigments with which it is mixed—the "drying" action, for instance, is influenced considerably by the pigment, some accelerating and some retarding it. On the other hand, the use of oil as a vehicle is an advantage where pigments fugitive to light have to be used. Dispersion in the oil to a large extent, although not so completely as in the use of wax, protects them from air and moisture, and the yellowing of the oil filters out the ultra-violet light which is the chief cause of fading. As I have explained, however,

most of the pigments fugitive to light used in mediaeval times can be eliminated from the modern palette.

The discoloration of the oil and the possibility of avoiding it has been a matter of much investigation. I would refer, for instance, to the valuable researches of Dr. Morrell* in this connection. But whilst this action can be minimized by careful purification of the oils, no method of eliminating it entirely has yet been discovered and the subject still offers a wide field for research.

All these inherent properties of the oil vehicle, taken together, affect materially the permanence of the finished painting, and the tendency to neglect taking them into consideration in modern painting must, I think, be held to a large extent responsible for the "ailing pictures" about which we have heard so much recently. That is why I suggest that the artist who wishes his work to live after him would do well to study the limitations of this medium. I would suggest, for instance, the danger of heavy impasto, and of superimposing masses of oil paint in the manner practised by some schools. If reasonable durability is to be secured it is desirable to keep the painting as smooth and even as possible, building up the picture in thin coats and allowing ample time for each to harden before the next is applied. I would advocate in short, a return to the painstaking methods of the earliest painters in oil—methods that have been handed down by tradition to craftsmen such as the coach painter, in whose work durability is a supreme consideration. If I might venture an illustration, which is admittedly an extreme case, I would ask anyone to visit the National Gallery and compare the present condition of two magnificent works of art—Vermeer's "Lady at the Virginals" and Turner's "Fighting Temeraire." The former is an example of the durability that can be attained with the oil medium, whilst the lamentable condition of the latter illustrates the dangers I have sought to describe. If we compare with this again Millais' "Ophelia," one of the earlier works of the Pre-Raphaelites, who sought to restore the craftsmanship of painting, we find in its present condition and brilliance some justification for the statements I have made.

Above all, I would caution against the addition of oil or oil medium to the paint to increase its mobility. The great thing is to

*R. S. Morrell and S. Marks. "The Yellowing of Drying Oil Films." *Journal of the Oil and Colour Chemists' Association*, No. 85, July, 1927. See also further papers by the same authors in No. 88, October, 1927, and No. 109, July, 1929.

keep the proportion of pigment in the paint as high as possible, remembering that any added oil vehicle has the opposite effect. It does not disappear on drying, but remains to swamp the pigment and aggravate all the defects I have described.

For instance, when I was more intimately connected with the preparation of artists' materials than I have been for some years, a very popular medium was in use made by adding Pale Boiled Oil to Mastic Varnish to form a gelatinous substance called megilp. Of all the pernicious materials which have been used by the unwary artist that is perhaps the worst, because it is so delightful to use and so treacherous in its effects.

Varnishes

The varnishing of pictures is a fruitful source of trouble from the point of view of permanence, and forms a problem very difficult to solve. In mediaeval times varnishes were introduced to finish tempera paintings, more especially to protect the many fugitive pigments that were employed, by covering them or "locking them up" with an impermeable film to protect them from air and moisture. With the transition to oil painting the necessity for their use was not so great, because the oil itself acts as a protection, although not so perfectly because it is not completely impervious. This necessity is further reduced at the present time because of the elimination of most of the fugitive pigments, but on the other hand modern paintings need greater protection from the chemically active impurities in our modern atmosphere due to the burning of coal, etc.

The current practice is to finish oil paintings with a spirit varnish, made by dissolving a resin, such as mastic, in a volatile solvent, which on drying by evaporation of the spirit coats them with a film of the resin. This film efficiently protects the paint from moisture and air and also filters from the light falling on it the ultraviolet rays which accelerate the chemical changes in the oil. But one has to pay for this protection. The resin film itself gradually darkens and loses its colourless transparency, turning to yellow and ultimately dingy brown. The inevitable result of this is that the picture steadily lowers in tone and acquires a dingy appearance, the design ultimately becoming almost indistinguishable.

When a varnish of this type has perished it can be removed, as it is soluble in the original spirit, the picture being restored more or less

to its original condition by cleaning and re-varnishing. But without venturing upon this highly controversial subject of the restoration of pictures, it would be an obvious advantage if we could discover a varnish of a more durable character. The Committee appointed by the Royal Academy in 1923 to investigate the durability of paintings devoted considerable attention to this problem and we found it extremely difficult to agree upon a satisfactory solution.

I was a party to the recommendation contained in the report of this Committee* that wax polishing is preferable to the use of resin varnish, but in my own practice I prefer the use of the hardest mineral or vegetable wax obtainable to beeswax, and a completely volatile solvent, such as toluene, to turpentine. There is a large painting by Mrs. Sargent Florence, in Chelsea Town Hall, which I treated in this way when it was executed twenty years ago, the condition of which is to my thinking testimony to the value of the method. One must stress the necessity of applying the wax thinly and whenever possible driving into the surface by heat to ensure the best results, and I do not suggest that this method offers a complete solution of the problem—one of the most useful directions in which systematic research could be directed is that of varnishes. One of the dangers of using resin varnishes on oil paintings is that cracking is greatly aggravated if the varnish is applied too soon. The reason is obvious if one appreciates the point that during the initial "drying" of an oil film it expands, and having reached that stage shrinkage commences. The varnish dries rapidly to a hard and comparatively brittle film, which is ruptured by the pull exerted by these volume changes in the oil film beneath. This effect is aggravated if the paint film is thick and often disastrous cracking occurs with impasto painting varnished too soon. The shrinkage diminishes progressively as the paint hardens and therefore the longer the painting is left before varnishing the less risk there is of this cracking. Another thing to be avoided is the use of pigmented varnish, which was much in vogue during the eighteenth and early nineteenth centuries, the final effects being given to the picture by glazing with transparent pigments incorporated in the varnish. When the time comes for cleaning, the removal of the varnish inevitably alters the balance of the picture by removing those glazes.

*Preliminary Report of the Sub-Committee of the Royal Academy on Modern Pigments and Mediums, February, 1928.

Painting Grounds

Finally we must realise that the preparation of the ground on which a painting is executed is of paramount importance to its durability. The evolution of painting grounds was from the natural rock or stone surfaces used in prehistoric times to prepared wall surfaces of plaster, thence to wooden panels and finally canvas, which from its convenience and lightness has become the predominant material in use today. As in the use of vehicles this facility and convenience has to be paid for in lack of durability, and the disintegration of the canvas itself is a constant menace to the permanence of modern paintings. This failure of the canvas is aggravated materially by the method in vogue of preparing it for the use of the artist, which consists of impregnating it with size and then priming it with white lead and linseed oil. This priming suffers from the defect of all oil paints, becoming discoloured and losing its elasticity with age, but a more serious defect is that introduced by the size, which swells and contracts with changes in the humidity of the air, so that the canvas is constantly on the move. Moreover its expansion and contraction are not equal, with the result that the canvas tends to sag in its frame. A further trouble is that size is an unstable organic compound, readily attacked by bacteria, with the formation of decomposition products which promote rotting of the cellulose fibre composing the canvas.

I think that the most useful work accomplished by the Committee to which I have referred above was that resulting from the investigation of this phase of the problem. I quote the following from the Report:

> "The first problem was to see whether it was possible to replace size by some other material, so as to obtain a canvas, the fibre of which would not swell with moisture. Experience during the war had shown that it was possible to impregnate a canvas or fabric with a solution of Viscose. The canvas is thus varnished by the same chemical substance as that of the main body of the canvas. Such a canvas is remarkably resistant to weathering conditions, and even when soaked for a long time in water it recovers its former volume on drying, remaining unchanged, whereas a sized canvas is permanently affected. A Viscose treated canvas is also less likely to be attacked by mould.
>
> "The Sub-Committee therefore arranged that experiments should be carried out by Mr. Cross with the assistance of an artists' colour firm on sizing canvas with Viscose. The results obtained seem to be quite satisfactory.

"Canvas after sizing with Viscose attracts about the same amount of water vapour as canvas sized in the ordinary way; but on exposure to moist air it shows no indication of swelling or change. A layer of oil paint laid upon the canvas after intermittent exposure to the temperature of boiling water and to air saturated with moisture shows no indication of separation or cracking. The Sub-Committee, therefore, are of opinion that this new method of sizing a canvas marks an important development."

I might perhaps explain that Viscose is a substance of treacly consistency obtained by treating purified cellulose (the essential constituent of vegetable fibres) with carbon bisulphide. Artificial silk is made by drawing the viscous mass into fine threads, which are then passed into a bath of acid, being thereby reconverted into the original cellulose. For application to our purpose the canvas is first impregnated with a solution of Viscose, then immersed in the acid bath, when the fabric becomes cemented together with cellulose.

General Conclusions

It will be evident from the foregoing that most of our difficulties with artists' materials, both as regards the ground, the pigment and the vehicle, arise from the use of materials of organic origin, which have inherent limitations as regards durability as compared with inorganic substances.

The method of painting in fresco, first developed by the Minoan painters in ancient times, was entirely free from any organic material. Such inorganic paintings were remarkably durable, but imposed such severe limitations on the artist as to be impracticable for general use, although fresco painting has been practised in this country in recent years with remarkable success.

When attention was drawn to the comparative failure of modern paintings, early in the last century, efforts were made to develop inorganic painting on improved principles, so as to avoid the limitations of this fresco process. I referred incidentally to the use of the water glass or "stereochrome" process by Herbert in the Houses of Parliament and I want now to show you an illustration taken from a paper, read in this room in 1895*, describing the paintings in St. Martin's, Wonersh, executed by a later and improved modification of the same

*Mrs. Lea Merritt and Professor Roberts Austen. "Mural Painting by the Aid of Soluble Silicates."—*Journal of the Royal Society of Arts*, December 6, 1895.

process due to Professor Keim. I have examined these paintings from year to year and I am confident they will retain their freshness indefinitely.

Keim's process forms the most durable method of painting yet devised, all organic material being avoided—the pigments being fixed by means of silica. Unfortunately there are two difficulties with it—it is only suitable for mural decoration, and the technique is too exacting to attain general popularity.†

The question is whether there is any possibility of finding an inorganic vehicle which will combine the permanence of such a method with an approach to the facility of organic vehicles. I firmly believe that the recent researches of George King on silicon esters‡ have brought this goal within sight. It would be premature to advocate the use of the process until the proper technique has been definitely established, but I may say briefly that the silicon ester medium has the effect of leaving the pigment bound to the surface with pure silica, without the necessity of the elaborate washing process involved in the use of water glass. Moreover it is applicable not only to mural decoration but to easel pictures; a special type of asbestos panel is now under investigation for use with it, and the whole painting would thus be inorganic throughout and all the agencies of decay removed. Meanwhile in spite of the greater charm and durability of tempera, oil painting will continue its predominance, and the point is, how to develop it to the best advantage.

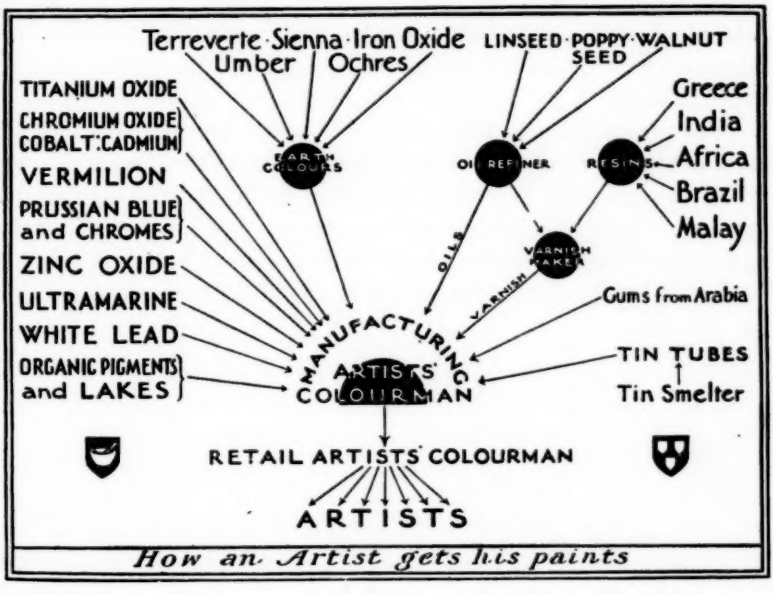
I have indicated the causes of failure, and suggested that in some directions organised scientific research is needed to investigate and control them. A great deal has been done, and a great deal more can be done, by further research. I would indicate, for instance, the possibility of still further extending the range of inorganic pigments, particularly at the red end of the spectrum: the possibility of controlling the chemical changes in the oil so as to eliminate the discoloration: the possibility of discovering a varnish free from the defects I have indicated. But whilst research can do a great deal to improve the permanence of artists' materials it cannot do everything, and I do feel

†I recently described the technical principles of this and other inorganic methods of painting in a paper entitled "The Possibilities of Inorganic Paint Vehicles."—*Journal of the Oil and Colour Chemists' Association,* December, 1930.

‡George King. "Silicon Esters and Their Application to the Paint Industry."—*Journal of the Oil and Colour Chemists' Association,* February, 1931.

that the real solution lies with the artist himself, for research can never eliminate the necessity for craftsmanship.

During the past few generations the artist has more and more lost touch with the materials he uses. I have indicated in the accompanying diagram the system which has grown up in modern times, whereby the artist obtains everything packed and labelled ready for his use. As a general rule even the artists' colourman does not prepare all the materials he uses, but obtains the various pigments, oils and varnishes from makers who specialise in the manufacture of one particular product or group of products. The artists' colourman specialises in the preparation of the paints from these materials, and supplies them to the artist through the retail distributors. This specialisation is part of the general economic system of our time. It is inevitable, and there is much to be said in favour of it, as I have indicated in speaking of pigments. I would not advocate a return to mediaeval conditions even if it were possible, and as it is frankly not possible we must do our best to overcome its disadvantages. The weak point is that this specialisation *appears* to relieve the artist from the necessity of knowing anything about the composition of his paints, with the consequent decay of craftsmanship.



How an Artist gets his paints

There are many artists who are alive to the situation, and I would especially pay a tribute to the founders of the Society of Painters in Tempera, that band of artists who have striven for the past thirty years to keep alive the spirit of craftsmanship in painting. But is it not a fact that these are a few amongst many artists who are largely ignorant of the nature and properties of the substances on which the existence of their work depends? It is extraordinary to think of the immense amount of skilled craftsmanship and technical knowledge developed in the humbler ranks of painting—to the decoration of ephemeral objects such as a cigarette tin or biscuit box—here today and tomorrow thrown into the dustbin. And yet a great work of art which is to delight the world for generations is often cheerfully undertaken with a minimum of consideration for the limitations of the materials employed. I suggest that whilst the scientist can do much to help, his researches can only be of value if they are rendered available to and assimilated by the artist. I am not suggesting for a moment that the artist should try to be a chemist as well—still less would I suggest that his art should be subordinated to science—at all cost the inspiration of the artist must be paramount and science the servant and not the master. What we really want is a closer co-operation between the chemist and the artist, and greater facilities for providing the student of painting with a knowledge of the nature and limitations of the materials he uses, which knowledge he gained in earlier times by practical experience.

The great difficulty, the difficulty I have striven to overcome for years, is to get *en rapport,* to understand one another's point of view and to interpret the technical language of the chemist so that the artist can appreciate what he is talking about. For it is as difficult for the scientific mind to appreciate the subtleties of artistic expression as it is for the artist to grasp the intricacies of chemical reactions.

RECENT RESEARCH ON VITAMINS*

Photochemistry, Crystalline Structure and Calcium Metabolism

RESEARCH on vitamins is making rapid strides and with it our knowledge of these hitherto elusive substances is becoming more definite and extensive. Much of the early work was carried out at Cambridge, and it is from this centre that Bowden and Snow, working in the Laboratory of Physical Chemistry, report (*Nature,* May 14, 1932, 720) some further interesting studies in the relationship of light to vitamins. These workers give an outline of a scheme planned to produce each vitamin by purely physical means. The scheme is based on the following principle:—A substance with characteristic absorption bands is liable to be attacked and its constitution altered when it is subjected to irradiation with rays of wave-length corresponding to those of its absorption bands. The rays from a quartz mercury vapor lamp extend over a wide range of the spectrum, but are particularly strong in such parts as 2540, 2650, 2967 and 3130 Angström Units. In irradiating a substance with the full "light" of such a lamp the various rays produce different effects which tend to mask each other. It is Bowden and Snow's intention to work with rays of single wave-length, and this is rendered possible by the use of the monochromator, an instrument which transmits as narrow a range of any part of the spectrum as may be desired.

Vitamin A

So far they have treated a solution of β-carotene (known to be changed into vitamin A in the body of some animals) in cyclohexane with rays of wave-length 2650. β-carotene having a weak absorption band at 2700 as well as others more strongly marked. They have by this means produced a substance with a band at 3280 which is generally accepted as characteristic of vitamin A. It would appear that they had, therefore, prepared vitamin A from β-carotene outside the animal body. It requires biological proof, however, and this is already being sought in the Cambridge laboratories. It is a simple matter to destroy the substance with the band 3280 by irradiation with rays of that wave-length or somewhat less. (3130 from the mercury vapor lamp.)

*Reprinted from *Phar. Jour. and Pharm.* (May 21, 1932), 411.

Vitamins B, C and D

The destruction of vitamin B_1 has been brought about by irradiation with rays of 2537 wave-length of a specimen of Jansen and Donath's crystals of B_1 which showed strong absorption bands at 2600, 2400 and 2100. This irradiation reduced the intensity of absorption at 2600, and if the biological test which was carried out on it is confirmed, it would appear that the absorption band 2600 is associated with vitamin B_1 activity.

Similar investigations of hexuronic acid, lately identified with vitamin C by Szent-Györgyi, were made. The absorption spectrum of narcotine, which, according to Rygh. is converted into vitamin C by irradiation, was also investigated, and at 2400 a complete change in the spectrum was produced. Examinations of the effects of light on a concentrate of vitamin C, hexuronic acid and narcotine are in progress.

Ergosterol (pro-vitamin D) and calciferol (vitamin D) have already been investigated by this method. Bowden and Snow hope to extend their work to the determination of the nature of the change which takes place when ergosterol is changed into vitamin D.

Crystalline Vitamins

In the same issue of *Nature,* Bernal, from the Mineralogical Laboratory, Cambridge, states that crystals of ergosterol and calciferol show the same absorption spectra as do their solutions with only a slight alteration of wave-length. Irradiation with monochromatic light brings about the same changes in the crystals as in the solutions, but certain reactions demonstrable in solutions (*e. g.,* the destruction of calciferol by rays of 2537) are not as easily demonstrable in the solid crystal. This difference may be due to the greater absorption by the calciferol in solution or to the formation of protecting layers on the surface of the crystal.

X-ray analysis of crystalline vitamins has not been carried very far, but promising results, particularly with regard to sterol structure, are recorded. Crystals of vitamin B, and hexuronic acid (probably vitamin C) show a large flat cell which, together with their strong negative birefringence, indicate ring molecules.

The Action of Vitamin D and Parathyroid Extract

L. J. Harris (*Lancet,* 1932, 20, 1031) has tried to show, from the evidence of experiments, that while vitamin D and parathyroid

extracts may each raise the level of blood calcium and/or blood phosphorus, they do so independently and by different means. Vitamin D performs this function by increasing the absorption of calcium and/or phosphorus from the gut, and thus depends on the supply of these constituents in the diet. Parathyroid extracts withdraw calcium and/or phosphorus from bone where it has already been laid down and thus enrich one part of the body at the expense of another. The former method is obviously to be preferred in treating this blood deficiency. The calcification of bone has been shown by Robison to depend on the presence of an enzyme, phosphatase, in the calcifying tissue. According to Harris, Robison curiously enough, has found relatively large quantities of this enzyme in the kidney and in the aorta, which, he contends, would account for the formation of calcareous deposition in those tissues if the blood were exceptionally rich in calcium and phosphorus. The difficulty admitted by Harris is that even when this diet contains very little calcium, excessive doses of vitamin D still draw calcium into the blood, but do so at the expense of the osteoid tissue. The proof that this is not done by stimulating the parathyroids does not yet appear to be available.

Hypervitaminosis

The amount of vitamin D which may bring about the condition known as hypervitaminosis D in young children is somewhat difficult to determine, as the standardization of concentrated preparations of this vitamin has only recently been made possible. A daily dose of 2000-6000 international units would appear to be safe for this curative treatment of rickets. Obviously the daily dose of any particular concentrate of this vitamin can only be determined from the known potency of the concentrate. A child would have to take six teaspoonfuls of an average cod-liver oil to obtain 2000 units of vitamin D. There is little chance of ill-effects from excessive doses of vitamin D when the diet consists essentially of natural foodstuffs.

OBITUARY

DR. JOHN R. MINEHART

Dr. John R. Minehart, Dean of the School of Pharmacy, Temple University, died in Temple University Hospital on May 10, 1932.

Death was caused by complications following an abdominal operation performed several months ago.

Although he had apparently recovered after the operation, Dr. Minehart, who lived at 4821 Germantown Avenue, suffered a relapse several days ago and was taken back to the hospital. He was fifty-four and was formerly a member of the old Common Council.

Dr. Minehart was appointed Dean of the School of Pharmacy in 1907 by the late President of Temple University, the Rev. Dr. Russell H. Conwell. Dr. Minehart was graduated in medicine and pharmacy from the Medico-Chirurgical College, where he was professor of materia medica for several years.

He was formerly a lieutenant in the Imperial Turkish navy, and once acted as surgeon on the Turkish cruiser Medjidia. In 1904 he was decorated by Sultan Abdul Hamid, of Turkey, with the Order Osmanian.

Dr. Minehart, a practicing physician, was also acting dean of the School of Chiropody of Temple University, having taken the place of Dr. Frank Thompson, who died a year ago.

He was born in Franklin County, Pennsylvania, November 1, 1878, and received his early education in rural schools and the Chambersburg Academy before enrolling in the Medico-Chirurgical College.

He was for many years a member of the Pennsylvania Pharmaceutical Association and of the American Pharmaceutical Association.

He was an elder in the Wakefield Presbyterian Church of Germantown.

Besides his wife, Dr. Minehart is survived by his mother, Mrs. Katherine Wise, 90, of Pleasant Hill, Franklin County; two sons, Thomas Z., a student in the Temple Law School, and John R., Jr., a student in Temple Medical School; a daughter, Miss Katherine Violet, and two brothers, T. Z. and C. D. Minehart, both of Chambersburg, and both former members of the Legislature.

Classes in the Schools of Pharmacy and Chiropody at Temple University were closed on the day of his burial by order of Dr. Charles E. Beury, President, as a token of respect to the memory of Dr. John R. Minehart, Dean of the Schools.

Members of the Faculty, Board of Trustees and students attended the funeral services in Wakefield Presbyterian Church, Germantown Avenue near Fisher's Avenue.

Following the services, the body was sent to Chambersburg, where burial was made in Pleasant Hill Cemetery.

Dr. Minehart was a forceful though quiet worker in the pharmaceutical field and his fine influence will be missed.

DR. VIRGIL COBLENTZ*

Dr. Virgil Coblentz, retired professor of pharmaceutical chemistry and former chief chemist for E. R. Squibb & Sons, pharmaceutical manufacturers, Brooklyn, N. Y., died unexpectedly June 7th of a coronary thrombosis in the West Philadelphia Station of the Pennsylvania Railroad, while awaiting a train to return to his home in Long Branch, N. J., after having attended the fiftieth reunion of his class in the Philadelphia College of Pharmacy. He was seventy years old and was born in Springfield, Ohio.

Dr. Coblentz was virtually born and raised in the drug business, his father, J. P. Coblentz, who had served his apprenticeship as a pharmacist, establishing a pharmacy in Springfield in 1862, the year in which Dr. Virgil Coblentz was born. Four brothers were also brought up as druggists.

Dr. Coblentz was graduated from the Philadelphia College of Pharmacy in 1882, when twenty years old, with honors, including the Procter prize and several other prizes and medals in materia medica and chemistry. In 1884 he was appointed professor of materia medica and toxicology at the Cincinnati College of Pharmacy, also being elected in the same year as President of the Ohio State Pharmaceutical Association. Three years later he went to Germany, where he studied at the Universities of Goettingen, Strassburg, and Berlin, earning the degrees of doctor of medicine and doctor of philosophy. He

*Reprinted from the *Oil, Paint and Drug Reporter.*

returned to the United States in 1891, becoming professor of pharmacy at the New York College of Pharmacy, now Columbia University School of Pharmacy.

He resigned his professorship and laboratory directorship in 1911 to become chief chemist for E. R. Squibb & Sons, with which firm he remained until 1917, when he entered private laboratory work, chiefly analytical and research chemistry, and pathological, bacteriological and clinical examinations. Since 1920 he had been pathologist for the Hazard Hospital, Long Branch.

His survivors include his wife, Anna; and two sons, Frederic C. Coblentz, Hollywood, Calif., and S. Philip Coblentz, Toledo, Texas.

MEDICAL AND PHARMACEUTICAL NOTES

THE CONTROL OF PHARMACEUTIC ADVERTISEMENTS—Prof. Marcel Labbé recently brought before the Academy of Medicine, Paris, a question of great importance. He read a number of advertising leaflets vaunting the merits of a product with a sorbite base, presented to the public as a sugar that has been deprived of all harmful effects for diabetics, whereas, according to Professor Labbé, sorbite is no better tolerated by patients than other carbohydrates. He demands, therefore, that the academy take the initiative in putting the public on its guard against these erroneous statements so harmful to public health, and take a firm stand against the selling with impunity of products likely to be dangerous. French laws are silent on this subject. There is absolutely no control of the value of products advertised to the public, except for serums and vaccines. The law demands only that the exact composition of the product be stated on the label. However, most manufacturers circumvent the law by placing the label on the bottom of the bottle and by printing the technical names in exceedingly small type and with the terms of chemical nomenclature, which are understood only by the initiated. As to the statements in the prospectuses concerning the curative effects of the product, they are formulated with absolute freedom and without any guaranty. It is evident that a system of control would be valuable in the interest of public health; but it is equally evident that the introduction of such a system would cause great confusion in the ranks of the pharmaceutic industry. Nevertheless, the Academy of Medicine has appointed a commission to study carefully the situation and furnish a report on the subject.—*Paris Report J. A. M. A.* 98, 1998 (June 4, 1932).

THUMB-NAIL SKETCHES II—WILLIAM BRISBANE—This early apothecary of South Carolina, on May 22, 1736, through the medium

of the South Carolina *Gazette,* called the attention of the public to the fact that he sold "round nipple glasses, streight & crooked nipple pipes, urinal glasses, Hungary water, Squire's elixir, spirits of scurvy grass, Lockyer's pills, sago almonds & all sorts of medicines either simple or compound at very low prices." Further he assures the readers that " The Compositions are prepared by his own Hand every two Months or oftner if there is a Demand for them & all Persons may be supplied with them very fresh and faithfully prepared, they may likewise have small boxes filled with such Medicines as is necessary to be kept at Plantations with proper directions how to use them."

Born in or near Glasgow, Scotland about 1710, William Brisbane was a "discipulus quintæ classis" in the University of Glasgow in 1726. He emigrated to South Carolina between 1731 and 1733 along with his elder brother, Robert, and set up an apothecary shop in Beadon Street, Charles Town. Subsequently he removed his business "near to the Quaker Meeting House" (at present, King Street) and still later to Tradd and Church Streets, where his successors continued to serve the community "at the sign of the Eagle" until after the Revolution. Variously styled "surgeon," Practitioner of Physick," "Druggist and Apothecary," "merchant," William Brisbane undoubtedly complied with the custom of the day and practiced medicine although he did not hold a medical degree.

Patent medicines must have formed a large part of his stock. Stoughton's Elixir, Godfrey's Cordial, Daffy's Elixir, Bateman's Drops, Turlington's Balsam of Life, Dr. James' Approved Fever-Powders, Hooper's Pills, Anderson's Scots Pills, and Jackson's Tincture he procured from Apothecaries' Hall in London. Tea and spices were imported through London or Liverpool, as were "Tooth Drawers and Lancets." For milady's vapours he offered "smelling Bottles" and his "fine Usquebaugh" gave gentlemen vapours of another sort.

Brisbane became a corporator of the First Baptist Church in 1745 and here his first two wives, Margaret Stewart and Hannah Staples, are buried; Eunice Stevens survived him, as did six of his eighteen children.

Serving his community through several epidemics of yellow fever and small-pox, William Brisbane apparently reaped ample mone-

tary rewards, for he owned several plantations and town lots and was able to loan 10,350 pounds, taking a mortgage on a plantation to secure it.

He visited his native land several times and, being in failing health, made his last voyage in June, 1771, hoping to derive some benefit from the change. Two days after his arrival he died, bringing to a close an unspectacular though none the less successful career of service in his chosen profession.

BOOK REVIEWS

APPLIED PHARMACOLOGY. A. J. Clark, M. C., M. D., F. R. C. P. 4th edition. P. Blakiston's Son & Company, Philadelphia, Pa. $4.00, 590 pages.

In November, 1929, we published a review in this JOURNAL of the third edition of Professor Clark's interesting book. We may remind our readers who do not have ready access to past issues of this JOURNAL, that this book does not pretend to give a systematic review of pharmacological facts but is rather a study of pharmacology principles. The author picks out important groups of drugs such as the arsenicals, the disinfectants, the hypnotics, etc., and discusses in some detail their modus operandi. We said at that time and repeat it now that for those who are interested in obtaining a general understanding of the basic theories on which the structure of modern pharmacodynamics is being erected, this book will prove of great value.

In the present edition the chapters on endocrines and on vitamins and on dermatological drugs have been the most extensively revised and the book well represents the modern pharmacologic viewpoint.

H. C. Wood, Jr.

THE PROPERTIES AND USES OF DRUGS. By Henry H. Rusby, Ph. M., M. D., D. Sc. A. Richard Bliss, Jr. A. M. Pharm. D., M. D., and Charles W. Ballard, A. M., Pharm. D., Ph. D. P. Blakiston's Son & Co., Philadelphia, Pa.

The subject of Materia Medica—or pharmacology as it is to be called in the new pharmaceutical curriculum—covers a wide range of knowledge concerning drugs. It includes a study of their botanical and chemical origins, their recognition and identification, their incompatability and dosage, their therapeutic and toxic effects, and in fact any knowledge we have of remedial agents. Textbooks on Materia Medica have perforce been compelled to emphasize one phase of the subject and to treat other phases more or less meagerly. Thus, we have

textbooks on Materia Medica in which the botany and pharmacognosy occupies 80 per cent. of the space; others devote practically all their attention to therapeutics and toxicology.

In the present volume, an attempt has been made to present a general summary of all phases of the subject. Obviously, it is impossible to go into great detail concerning any one division of the science. To do so would of necessity result in a volume far too large for a students' textbook.

The high standing of the authors in their profession should be a sufficient guarantee of the authoritative character of the work. They apparently had in mind the preparation of a book suitable for a textbook rather than a reference work for the library of the pharmacist. There is, however, a large amount of useful information, especially concerning the newer drugs, for which the practitioner might be very grateful. As the book is intended primarily for the use of students it is logical that the subject matter should be divided according to the therapeutic classification rather than the botanical or chemical. A rather unusual feature is three appendices covering subjects more or less closely related to Materia Medica. Appendix A on Insecticides, Fungicides and Fumigants gives to the rural pharmacist information concerning the various preparations used for the destruction of garden pests—from moles to potato bugs. Appendix B on Pharmacal Sundries has a brief description of some of the common appliances, such as syringes and hot water bottles, which are sold in drug stores; and Appendix C, which is also intended for the practitioner in the country districts, is a veterinary dose table giving doses for horses and sheep of the drugs most frequently used for these animals. The space which can be given to these subjects necessitates a rather sketchy consideration and a reviewer whose life has been spent in urban surroundings must hesitate to pass upon the utility of such a chapter.

While we find much to commend in this book we must confess that there are certain features which are not so pleasing. For a students' book the typography might be greatly improved. We believe with a different typographical arrangement a great deal of space would have been saved and there would have been avoided a certain amount of confusion in the student's mind. There has also been introduced, more or less frequently, consideration of various subjects such as

classification of foodstuffs, government definitions of spices and flavoring extracts which did not seem to us part of the subject; why an entire page should be devoted to the milk mixtures for infant feeding recommended by Mead, Johnson and Company is a conundrum. The space which would have been saved by some timely deletions might well have been devoted to some description of the physical appearance of the vegetable drugs, a feature which is notably lacking.

H. C. Wood, Jr.